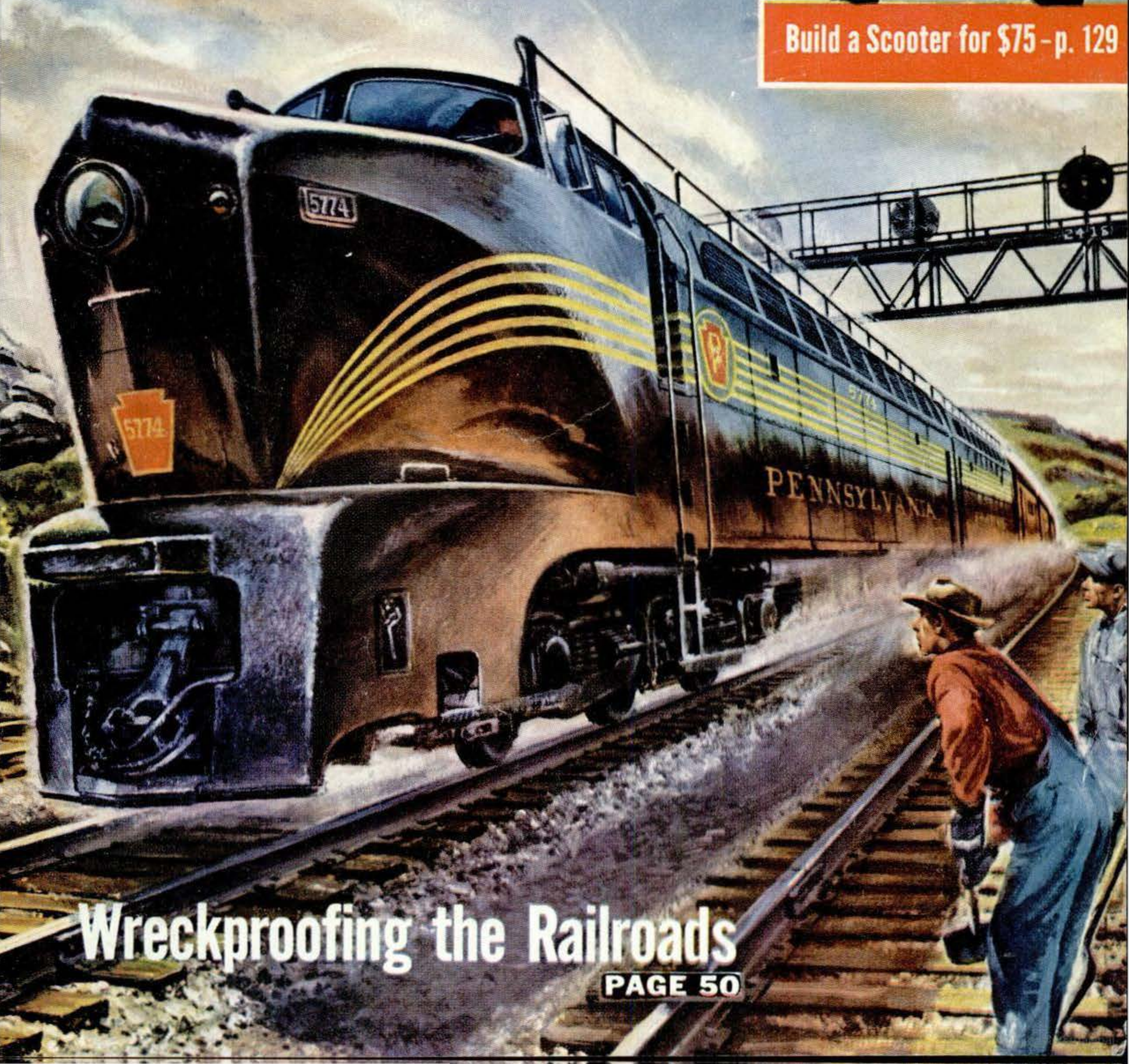
POPULAR SCIENCE

MONTHLY

MECHANICS AND HANDICRAFT

25¢ July, 1951

Build a Scooter for $75 - p. 129



Wreckproofing the Railroads

PAGE 50

A rust-clogged radiator overheats, causes trouble and expense

CLEAN OUT RUST

with

DU PONT *Cooling System* CLEANSER

You can prevent engine overheating by cleaning out rust, scale and scum in the cooling system. Just pour in a can of DU PONT CLEANSER, run the engine for 30 minutes or more, then drain. It's easy to do, cleans thoroughly and safely. No reverse flushing is required.

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One of the most useful new tools, with a tried and proven method of locating and identifying mechanical troubles, the MULTISCOPE works on the same principle as a doctor's stethoscope. The steel probe picks up noise vibrations and the diaphragm in the sound chamber amplifies them. By tracing the intensity of the sound you can locate and identify the trouble where the sound is clearest and loudest.

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Simply place ear pieces in both ears snugly to exclude outside noises. Grasp the plastic handle between thumb and index finger as you would a pencil. (The plastic handle insulates you from electric shock). Place the probe firmly against the part, or area, where the sound or trouble seems to originate. Move the probe around until you find the spot where the sound is clearest and loudest. This will indicate clearly just where the trouble is.

With a little practice you can identify by the pitch, or tone, what internal part is making the sound. For example, a piston slap is lower in pitch than a loose valve, etc.

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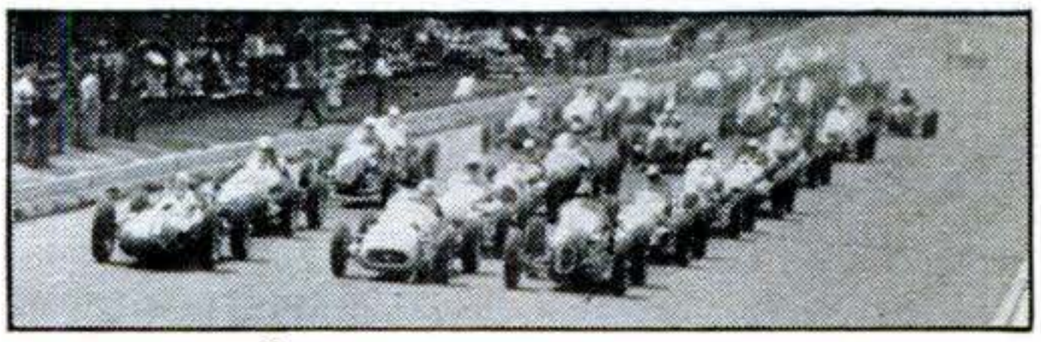

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THE MAGAZINE OF NEW AND USEFUL IDEAS

Founded 1872, Vol. 159: No. 1

POPULAR SCIENCE
REG. U. S. PAT. OFF. *Monthly*

Mechanics and Handicraft

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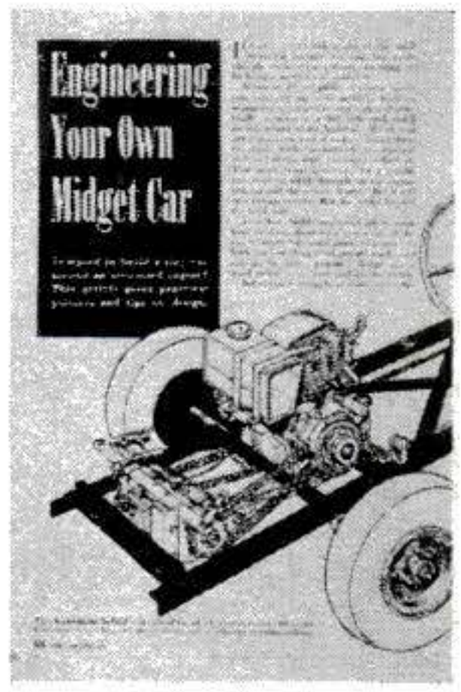
Third Lap for PS Micromidgets

Mechanics started scrambling when this PS article appeared in December, 1948. Their cars completed, several Indiana mechanics formed a club, started racing.



. . . And in October, 1949, PS told you about their little cars in "Homemade Racers Hit the Dirt Track." This inspired a group of Texans to get up speed too. So . . . Next month PS presents how-to-build dope on a 60-m.p.h. mite created by a Dallas reader.

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Letters

Voice of Authority

In your May issue, p. 112, you describe a hinge to hold a garbage can lid onto the can.

This in my opinion is the silliest idea you have ever published. In my business as garbage man I have come across all types, even one as you suggested. A man would have to have three hands to dump such a deal ef-

ficiently, the left to hold bottom of can in an upward position, the right to hold the top in a downward position, and a third hand to hold the lid back from getting in the way and getting all smashed up.

A much more efficient deal would be to take a small piece of chain, such as a dog leash, hook it to the handle on the side, and then snap it to the lid on top. When the lid is removed it hangs down out of the way.

IVAN SMITH, Hot Springs, S. D.

Reader Interest

I wish to thank you for making it possible to buy such a fine magazine. All the articles are interesting, especially Gus's Model Garage and the stories by Wilbur Shaw.

RONALD CAOUETTE, Anoka, Minn.

Taken to the Cleaners?

Perhaps some well informed PS reader can settle a long standing disagreement.

When the vacuum hose on a tank cleaner is stopped up the motor sounds different. My boss says this is because the fan is running in a partial vacuum, therefore it revs up. I insist it is the motor laboring to hold the vacuum against the higher pressure on the other side. Who is right?

JACK STEWART, Waukegan, Ill.

Chances are your boss has you. The motor labors to make the vacuum, not to hold it, and it has more to do when there is more air than when there is less.

Auburn Speedster

Every month I read letters from your readers boasting of the merits of their Cords and Duesenbergs, but never once is there mention of the brother of these fine cars, the Auburn Speedster.

The Cord is a direct outgrowth of the old Auburns. Mr. E. L. Cord first built the Auburn Speedster to compete with the famous Chrysler Imperial Roadster, then he turned his efforts to build the front-wheel model known as the Cord.

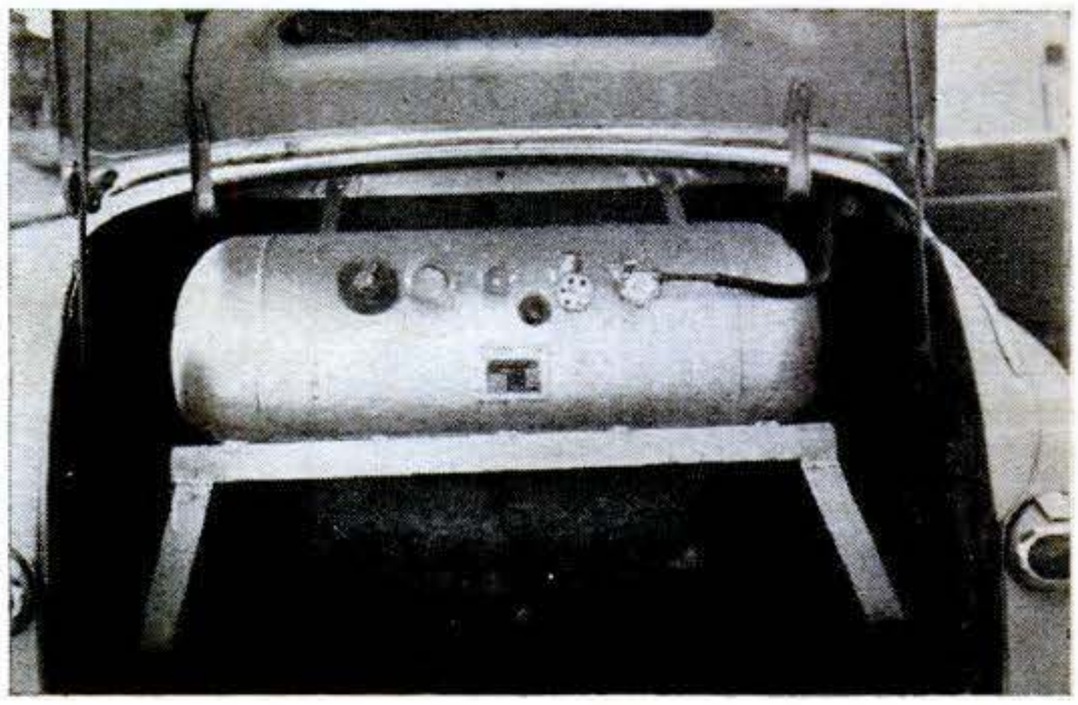
I'll admit that there are several disadvantages to the Auburn. The most obvious is the three-speed gear box. The other is the limited seating capacity. Enough of the bad points. The Speedster has the eye-catching "boat-tail," disappearing top, and slanting Vee windshield. Another feature is the ease with which the car may be worked on.

The sensible styling, excellent handling qualities, and the dependability of these fine cars, both Cords and Auburns, appeal to car lovers the country over.

PETER MEINERSMAN, Oswego, N. Y.

Burns Butane

After reading the article and letters to your magazine on the use of LPG [liquefied petroleum gas] I thought you might be interested to know that I have been using butane and LPG in my Ford convertible for four years. I installed the equipment



when the car was new. The equipment I installed is manufactured by Roadmaster Products Co., and is the combination type. I can use either gasoline or butane by turning two switches on my dash. With my bu-

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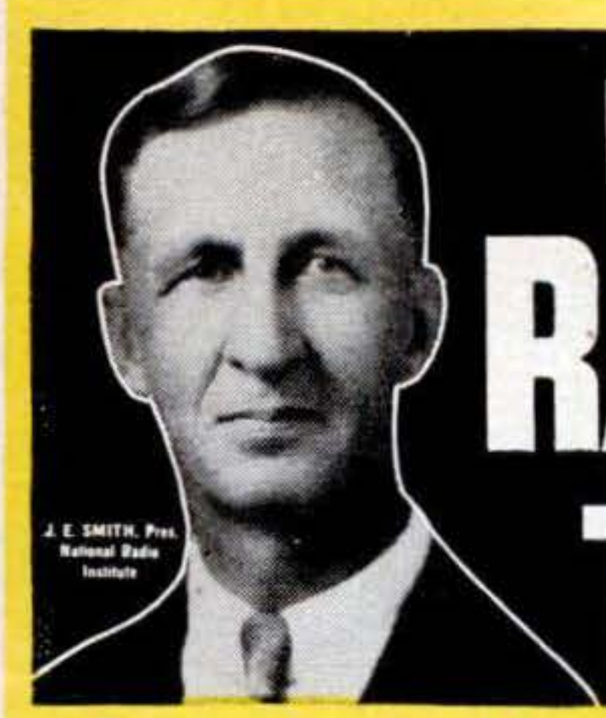

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tane tank plus the gasoline tank I have a long cruising range.

The only repairs I have had on my car since it was driven off the showroom floor have been one muffler and two motor-tunes.

FLOYD C. BAIN, Portland, Ore.

Grip Gripes

I hate to see people get hurt, and that's what is going to happen if a lot of people follow the suggestion in "Keep Your Tools Fit" in PS for January, p. 201, on sanding and waxing stepladders to make it easy to remove stains.

The stepladder would then be very unsafe because sanding and waxing will make it too slippery.

Wouldn't it be much better to use shellac mixed with fine sand? You'd get greater traction and have a protective coating at the same time.

EUGENE F. MOJEWSKI, Cleveland, Ohio

Under the Gun

The Russian Degtyarev Model 1934-1938 submachine gun has a double line, staggered box magazine of 25-round capacity, not a drum magazine as you stated in the last paragraph, page 109, of your March article, "How Good Are Russian Guns?"

Also, the Colt .45 caliber pistol pictured on page 108 is the Model 1911A1, and the "grease gun" on page 111 is the M3A1.

RONALD LUCHS, Glen Ellyn, Ill.

The Degtyarev 1934-38 was issued with a 25-round box magazine as Reader Luchs notes. However, when the Russians came up against the 70-round Finnish Suomi pistol, they modified some Degtyarevs to take a 71-round drum. It is one of these that was shown.

Reader Luchs is right about the model numbers of the Colt and grease gun. The differences are minor, however, and in each case the operation is identical. For a full view of the M3A1 grease gun and how it works, turn to page 83 of this issue.

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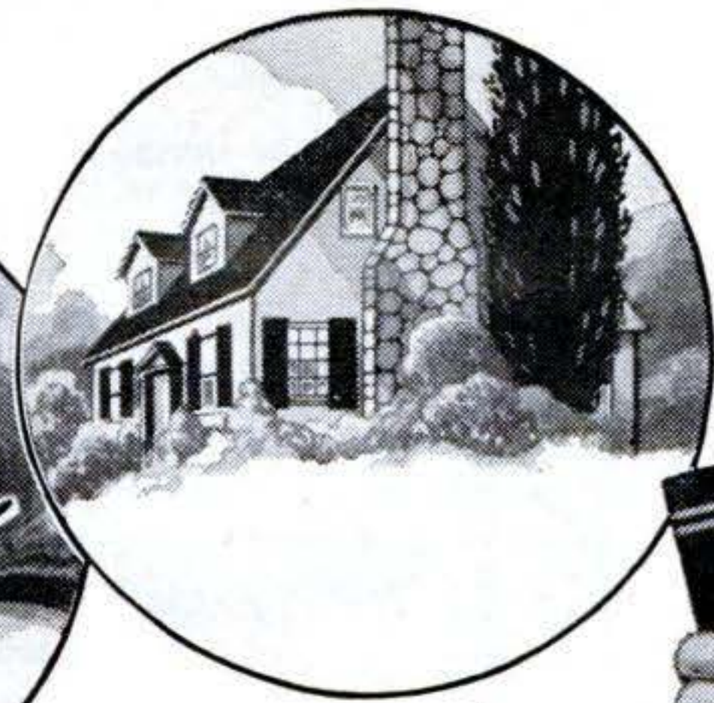
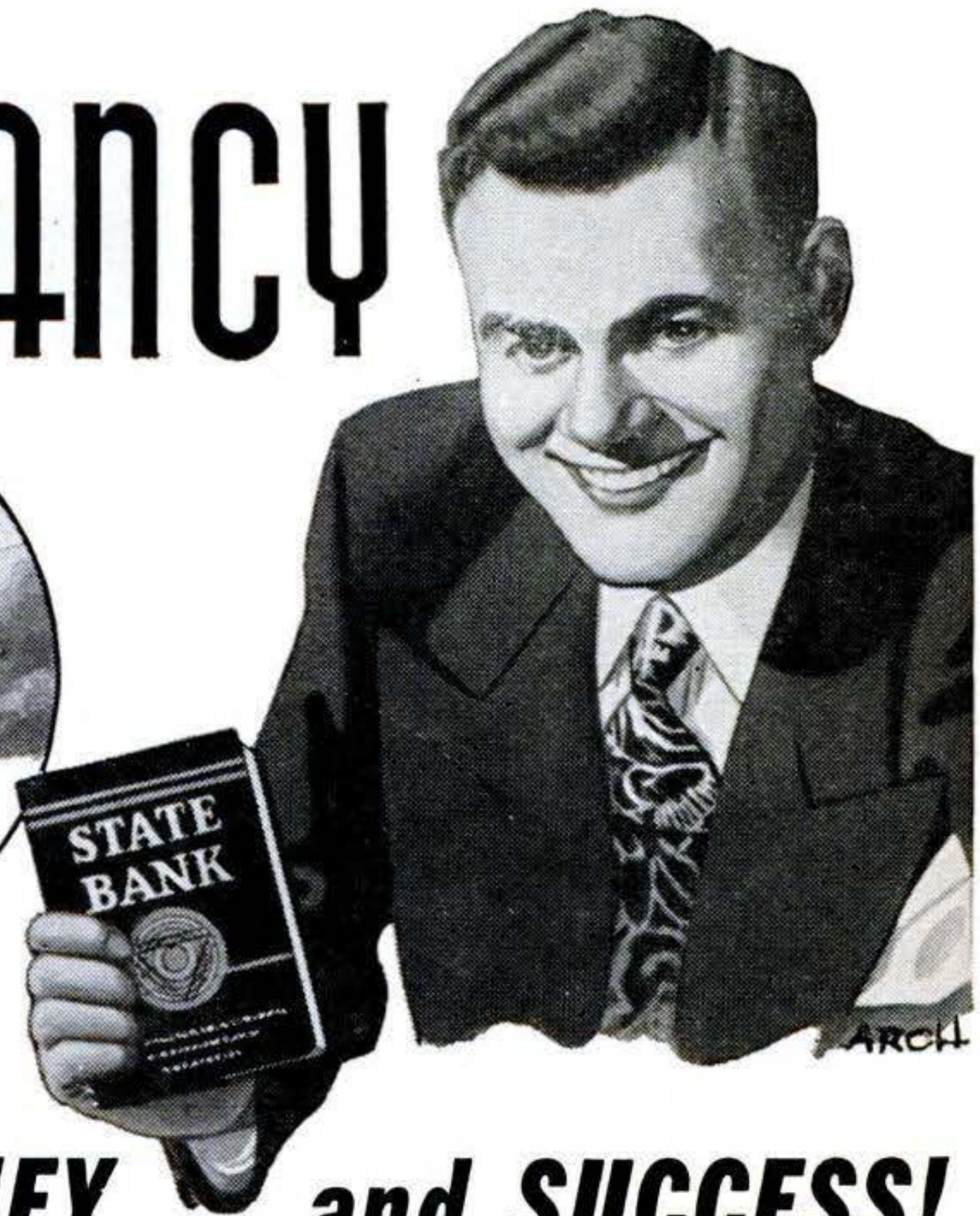
5 *reasons why* ACCOUNTANCY





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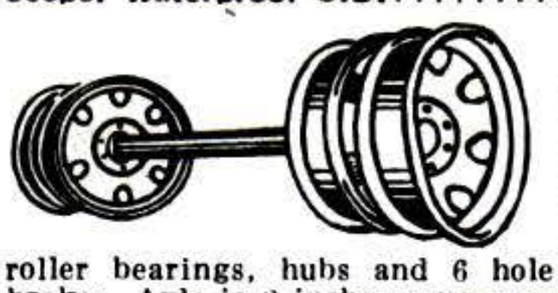

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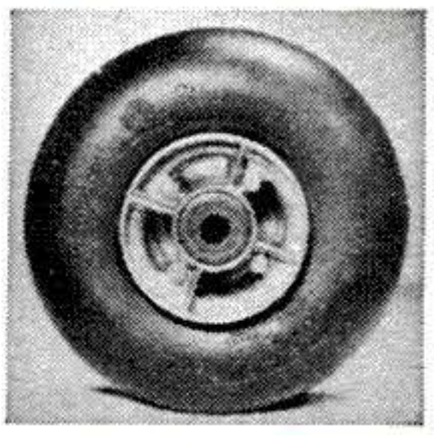

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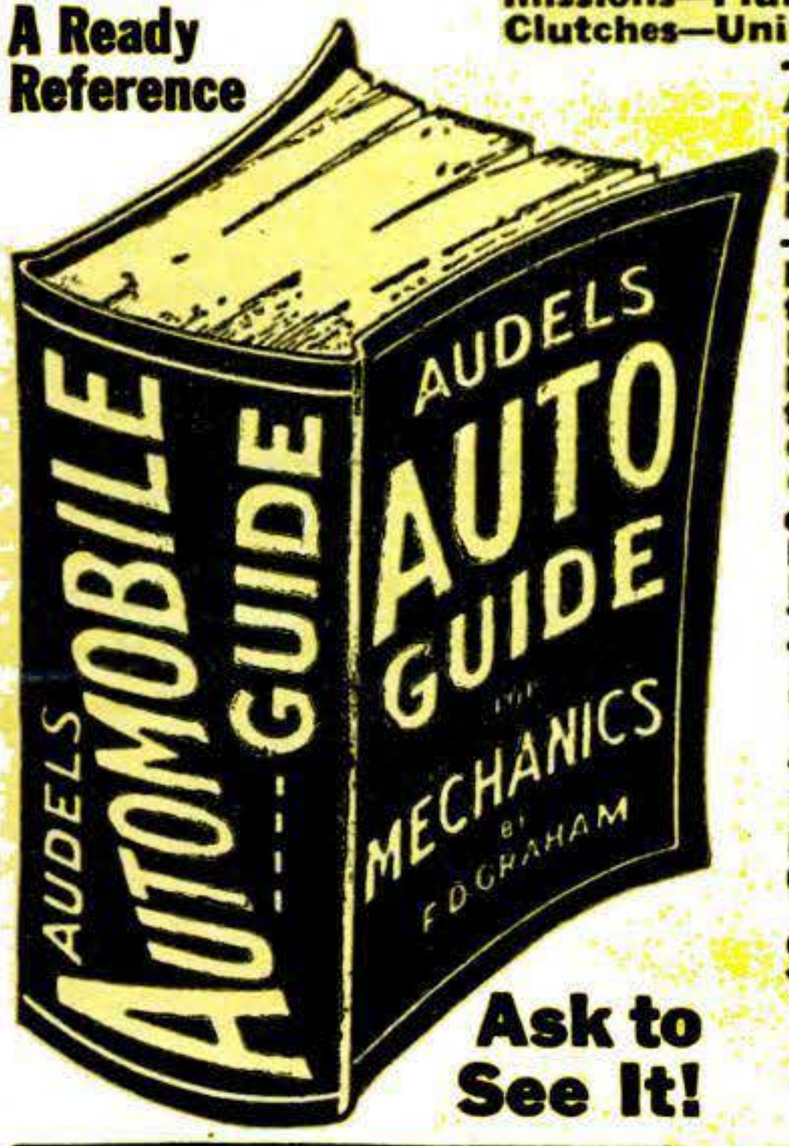

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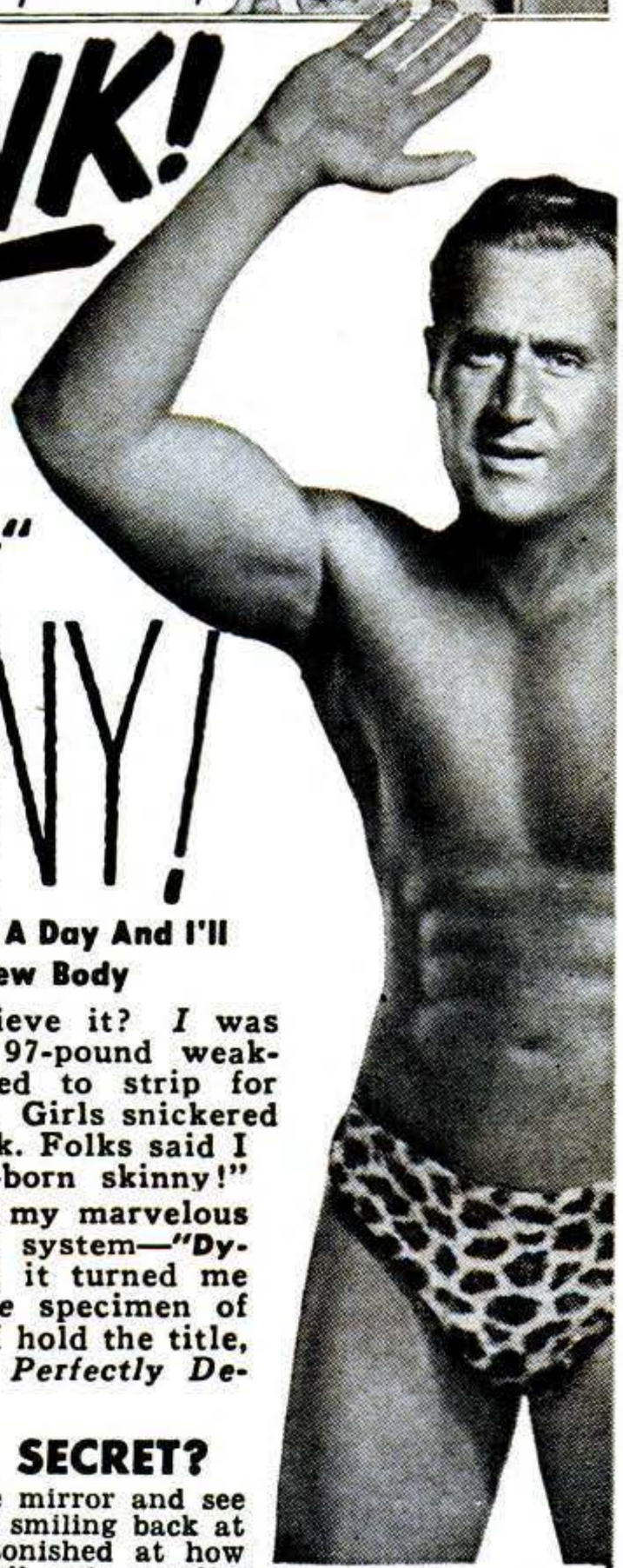

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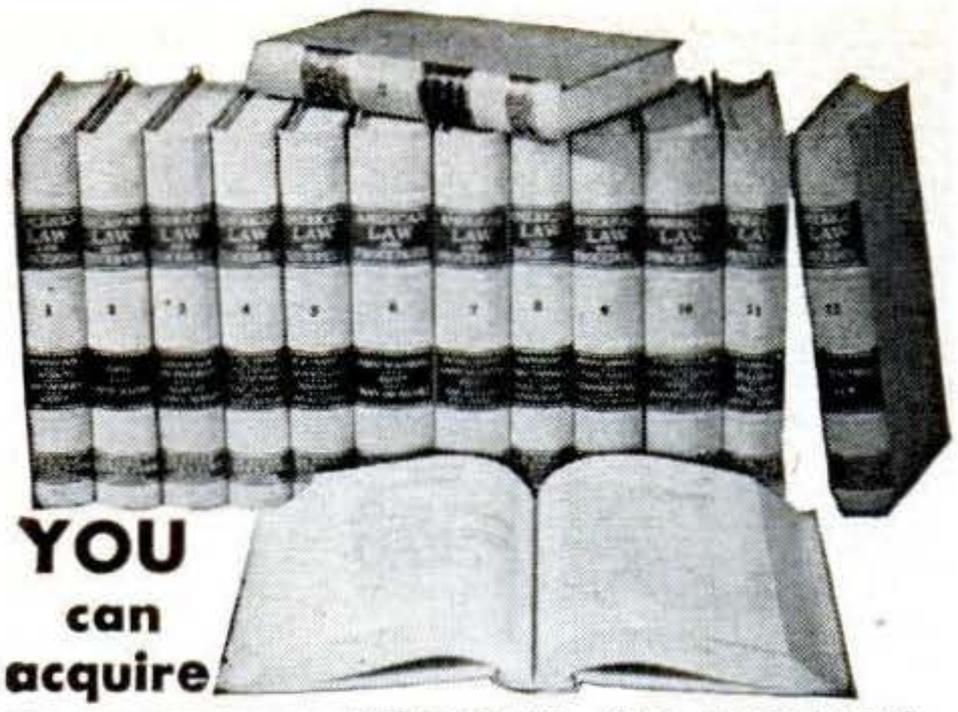

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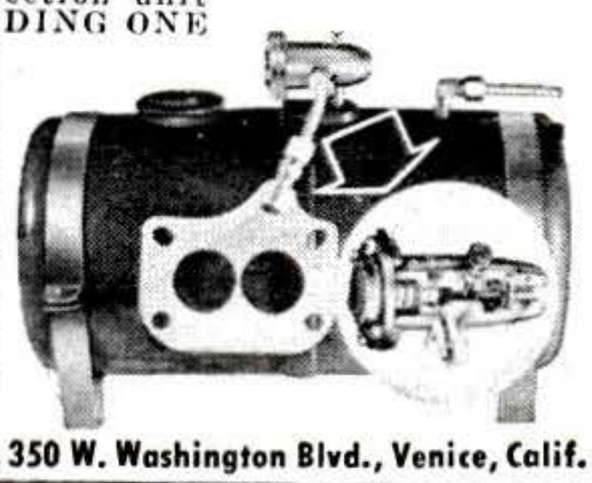

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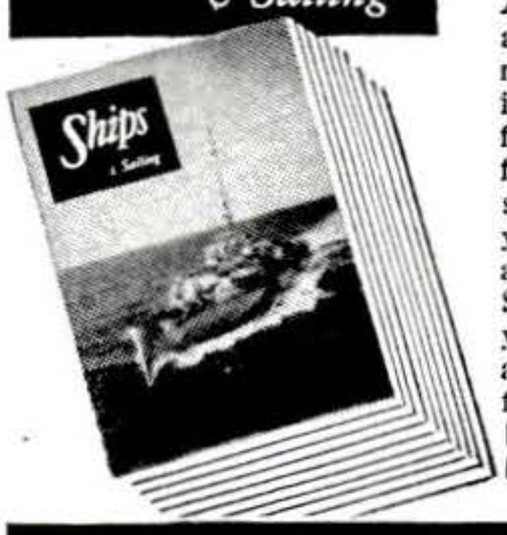

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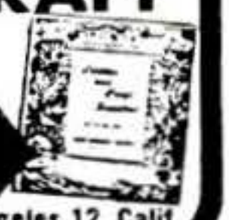

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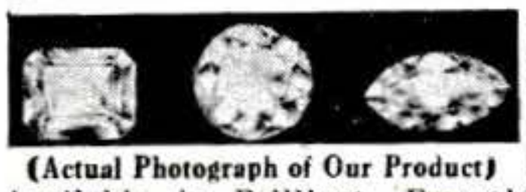

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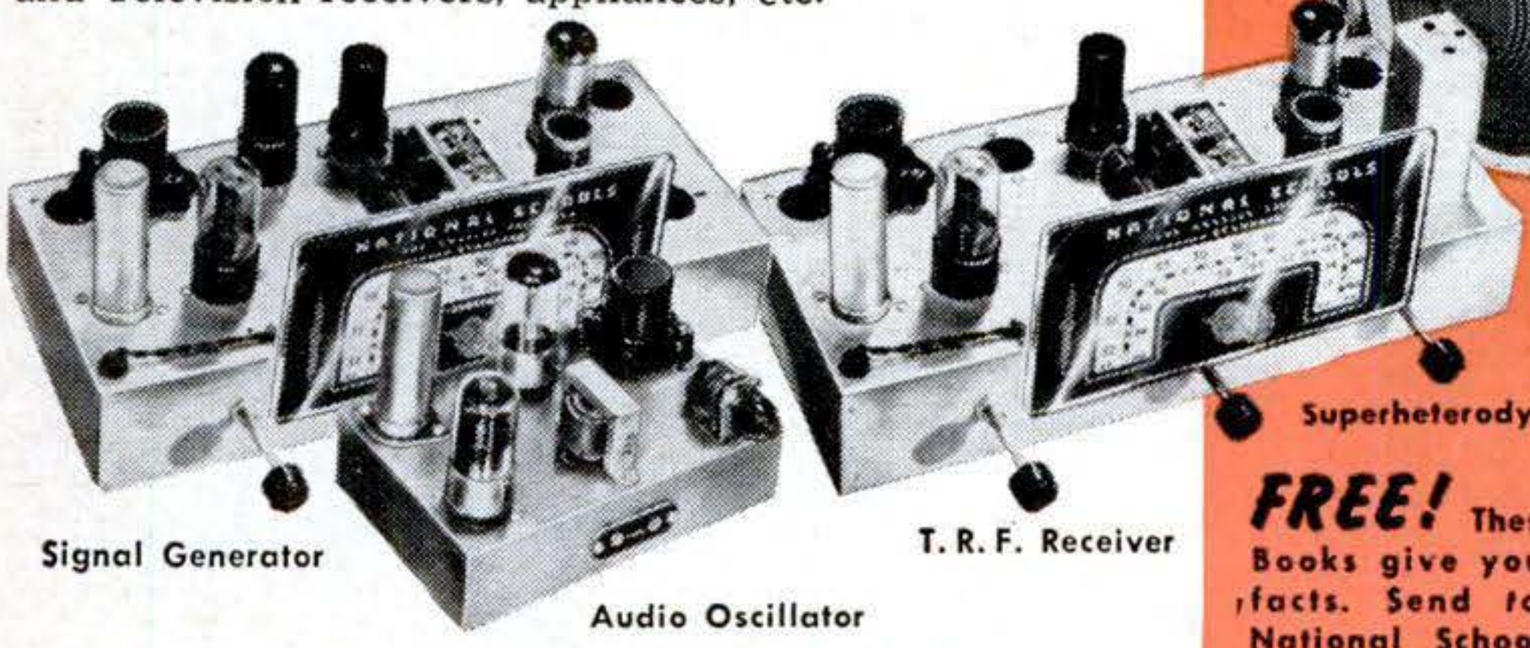

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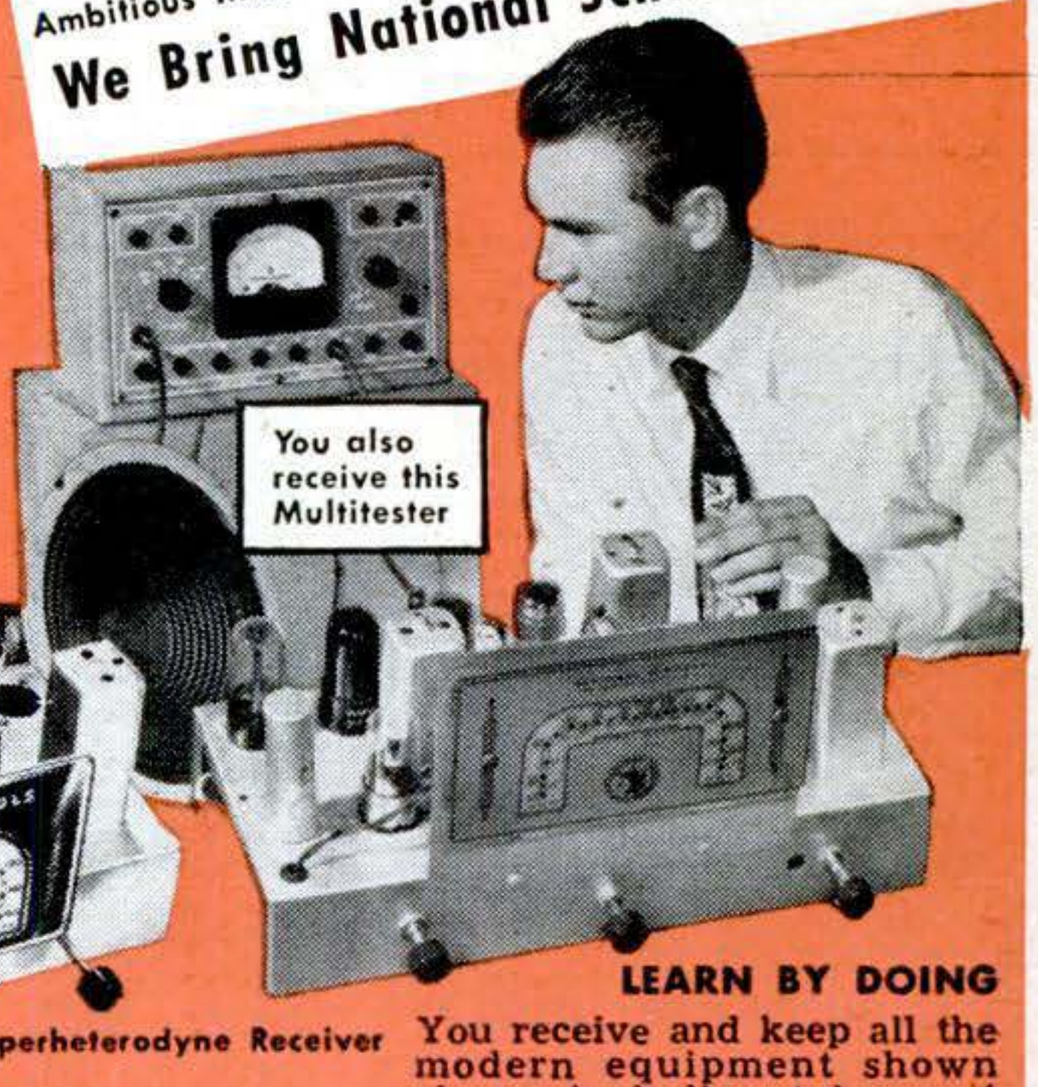

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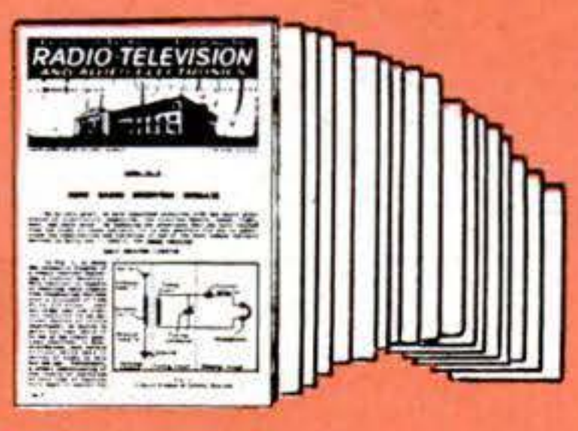

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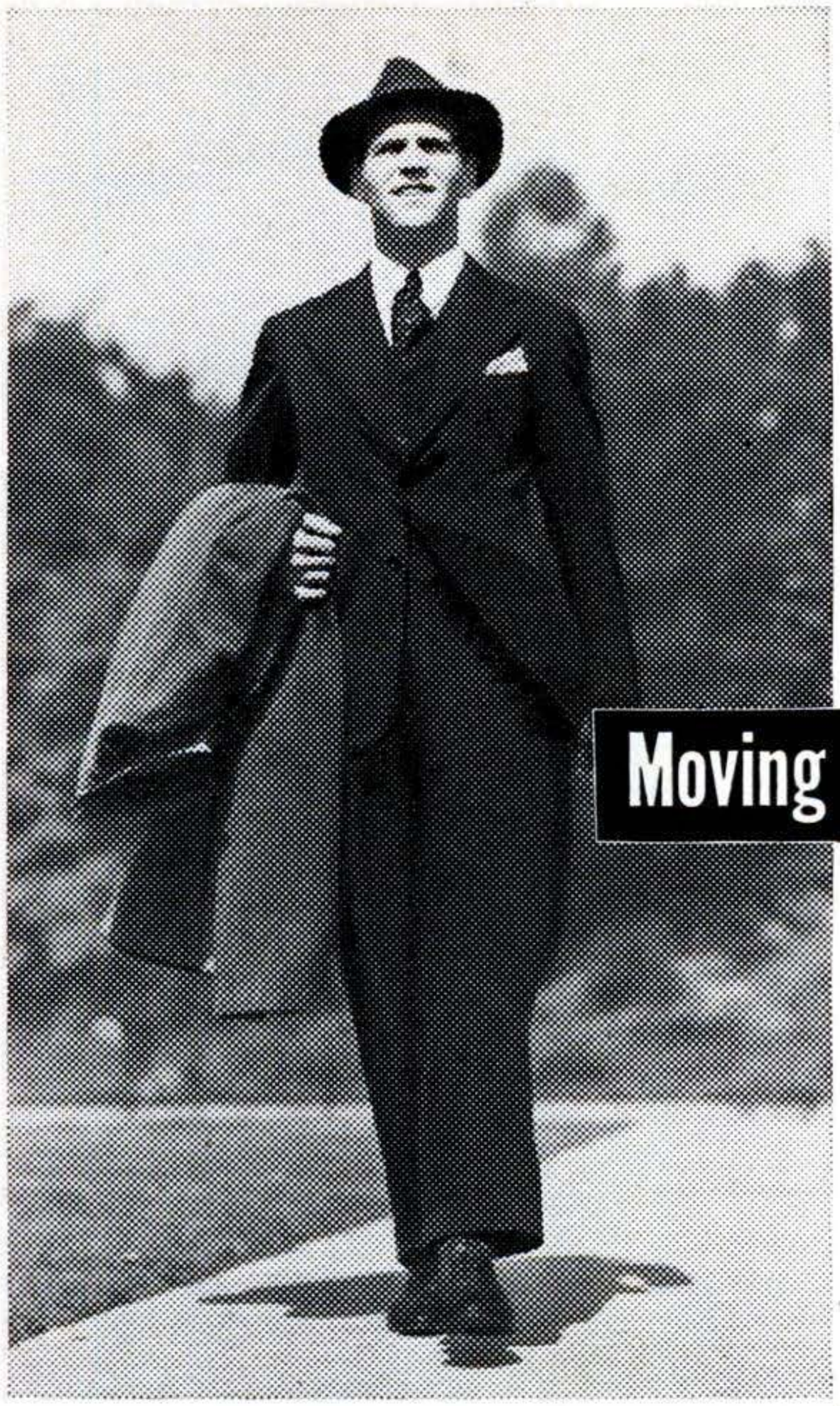

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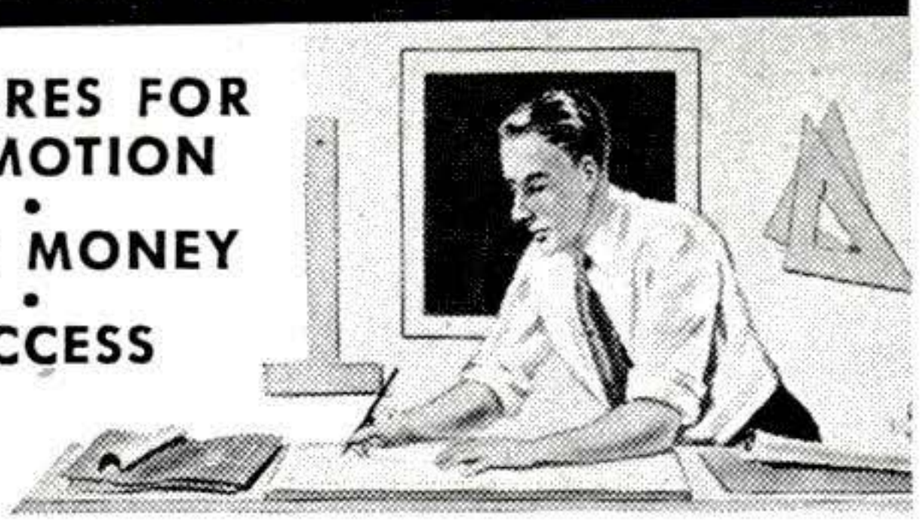

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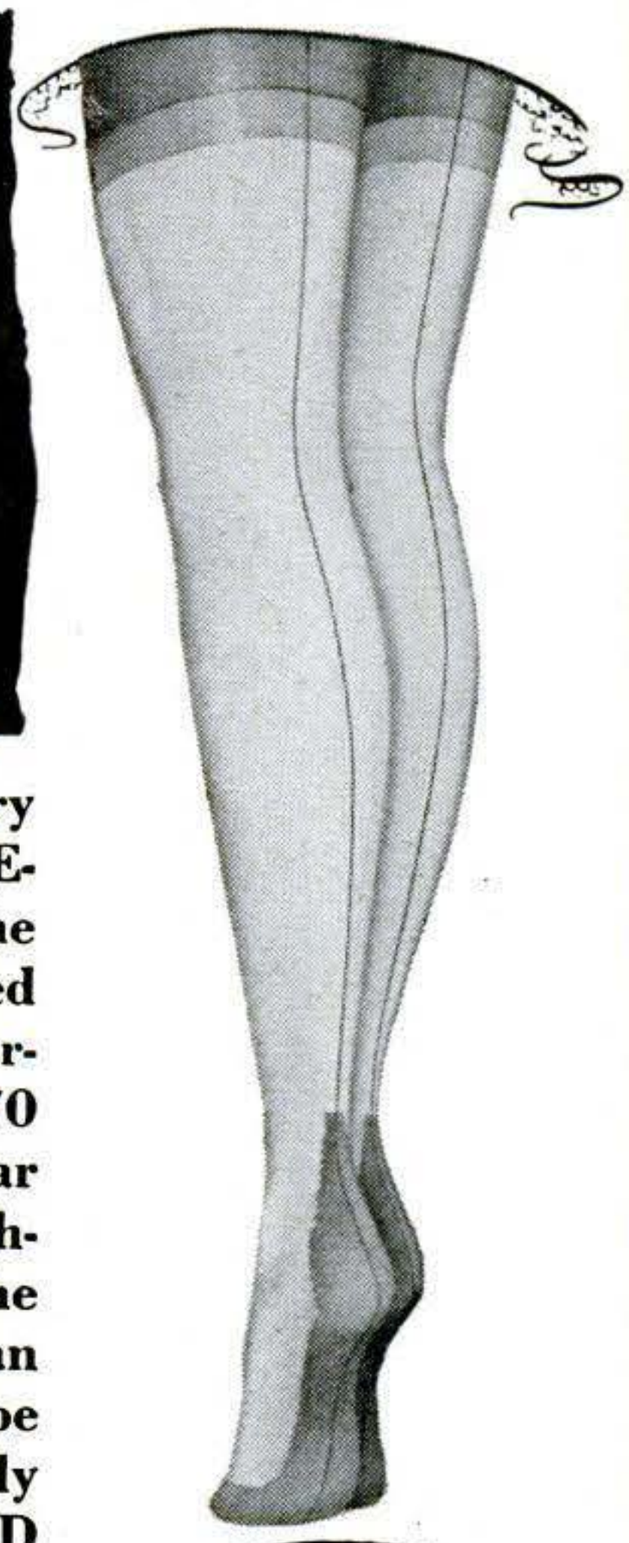

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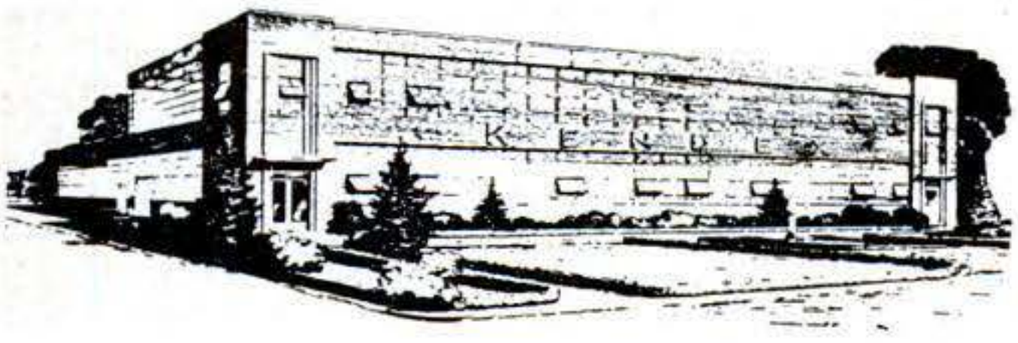

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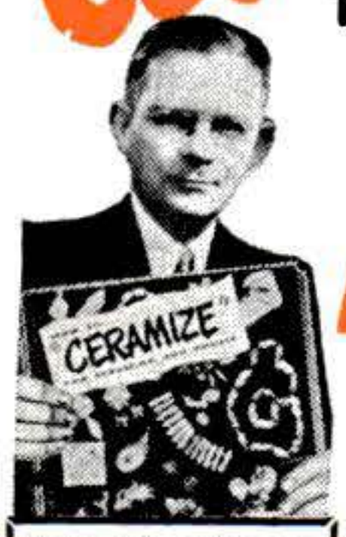

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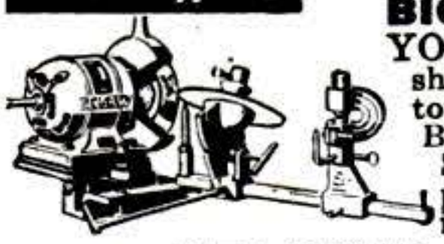

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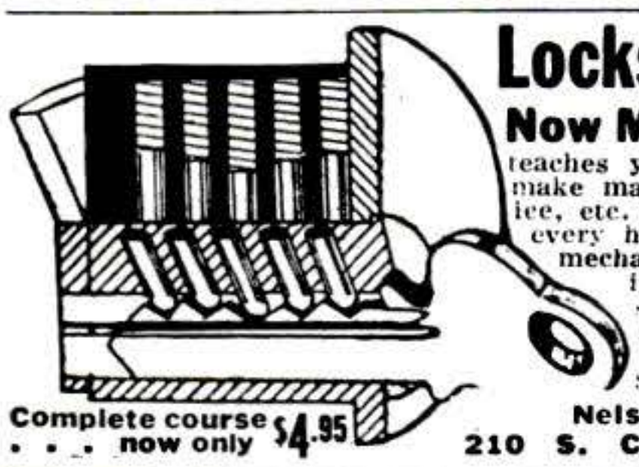

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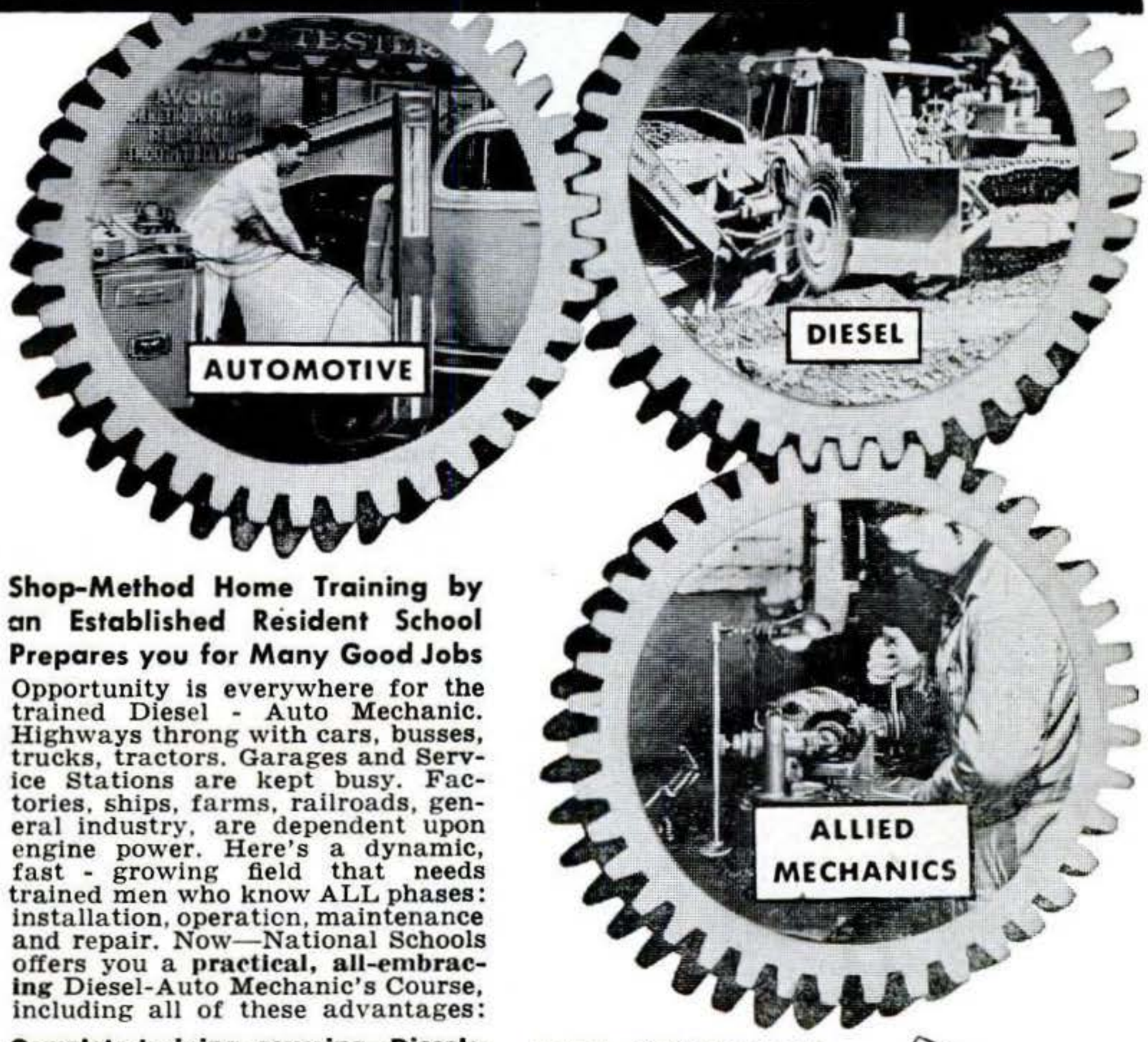

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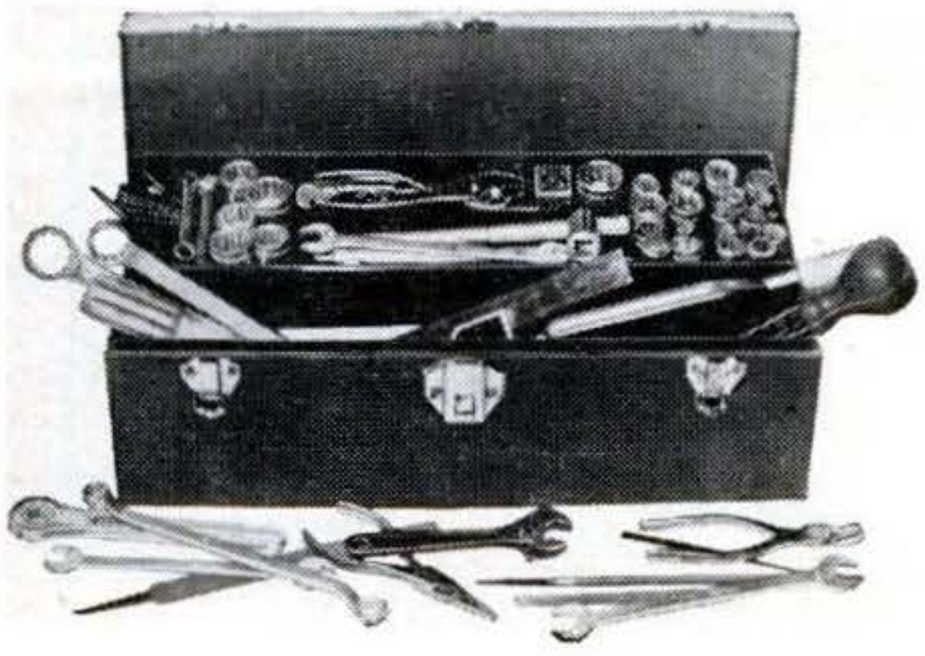

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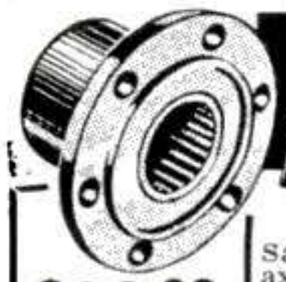

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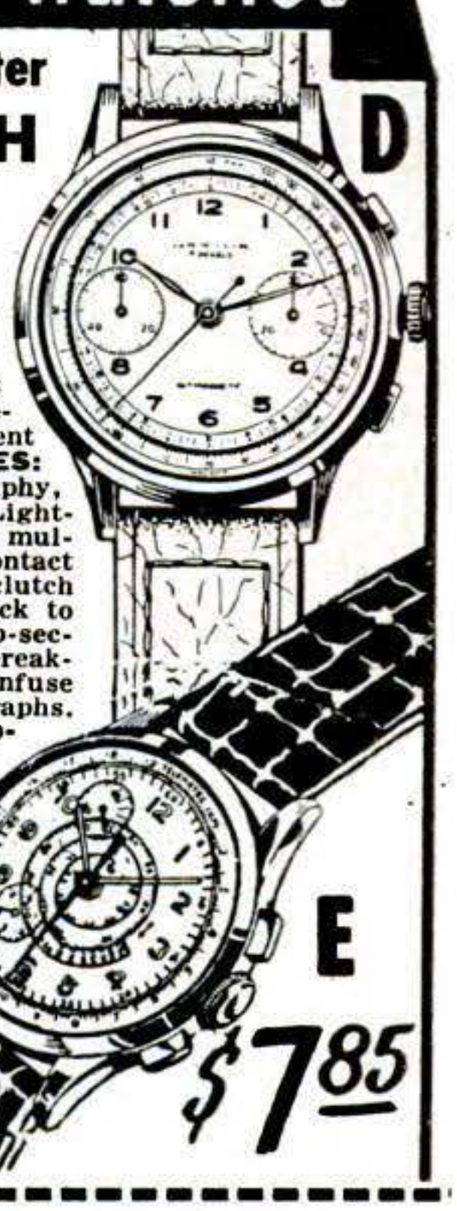

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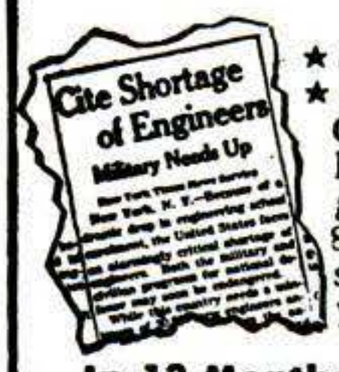

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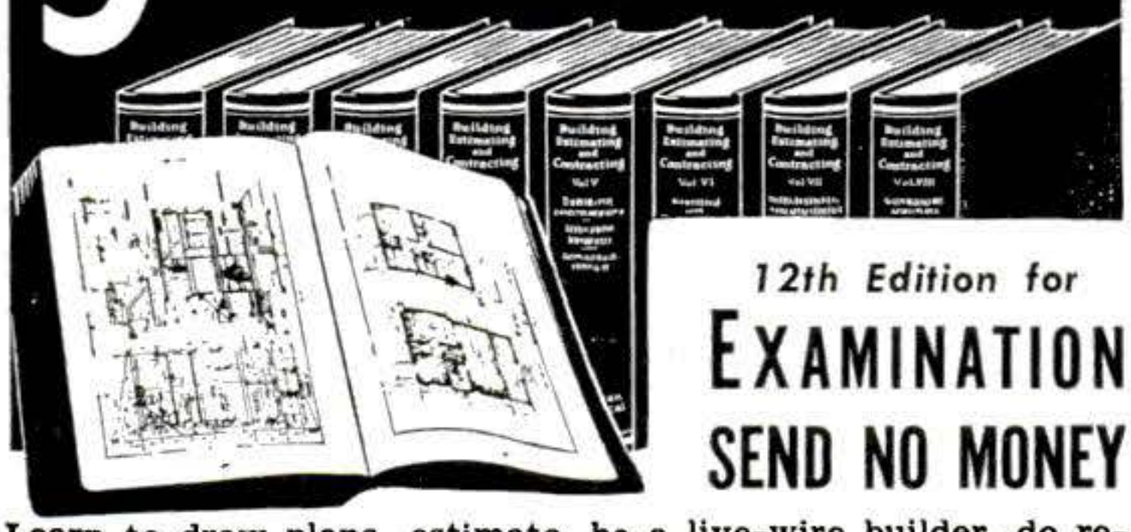

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650-16	6.42	670-15	6.24	650-20	9.94	1000-20	18.54
700-16	5.94	700-15	6.54	700-20	11.94	1100-20	18.54
750-16	7.94	710-15	6.34	32x6(8)	10.54	1000-22	17.54
550-17	5.[illegible]4	760-15	6.54	32x6(10)	13.92	1100-22	18.5[illegible]
525-18	5.[illegible]4	820-15	7.04	750-20	12.54	1200-22	22.54
650-19	9.00	4[illegible]5-19	5.94	825-20	22.84	1100-24	21.54

900-16		600-16		Military		750-20	
Reg.	$10.94	Reg.	$6.75	Reg.	16 mos.	Reg.	$10.44
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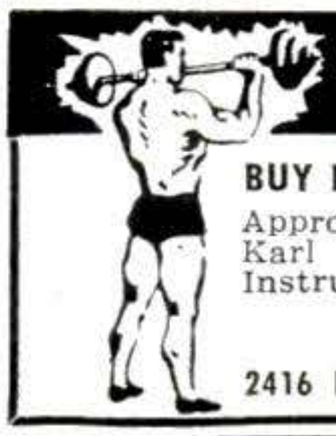

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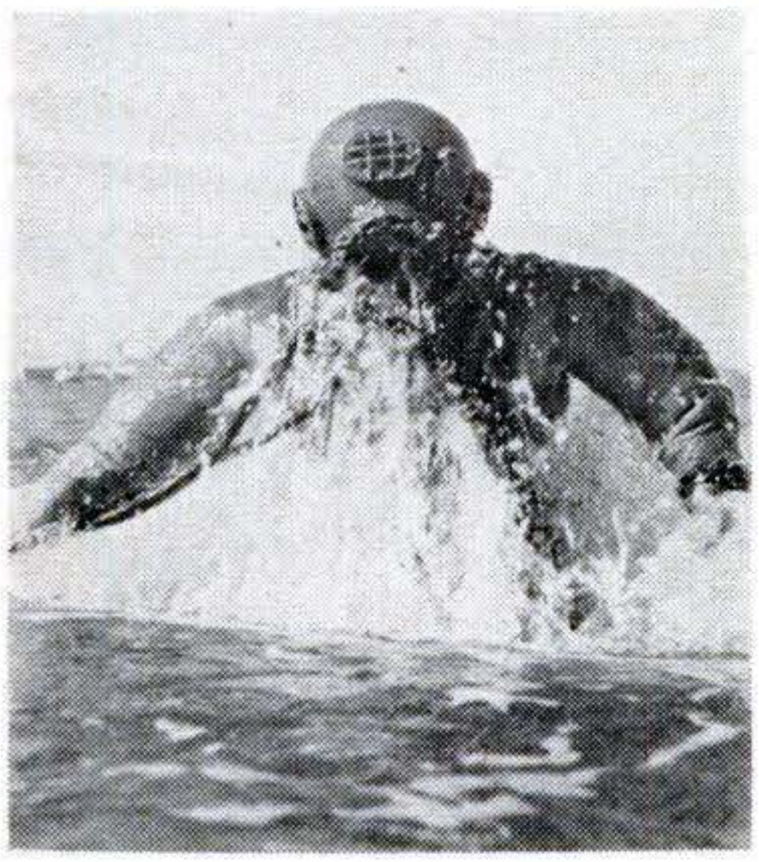

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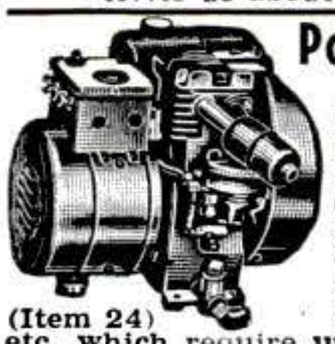

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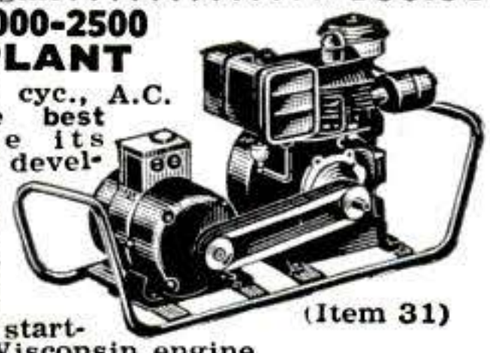

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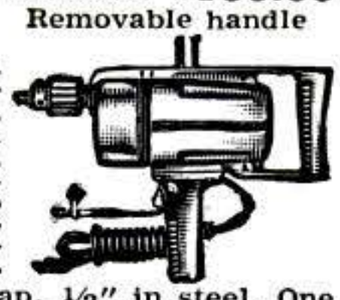

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(Item 33) DeLuxe model —powerful, smooth running, precision built. Handles toughest jobs. Cutler-Hammer switch, **Jacobs** key chuck. 110-120 v. AC-DC 300-450 rpm. Alum. alloy case for high strength and easy handling. Built-in blower assures cool operation. Cap. ½" in steel. One year written guar. Wt. 11 lbs. Should be $65. Special..... **$34.50**

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38 Pc. DRILL KIT

(Item 35) Includes above illus. guar. drill, buffers, polishing bonnet, sanding discs, grinding wheels, wood bits, steel bits, wire wheels, bench stand, paint mixer, burrs, Complete in heavy steel case. Wt. 13 lbs. 38 pc's., all highest quality. Complete kit worth $38.50. Our Spec. only... **$19.85**

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(Item 38) Use as portable or shop welder. 250 amps, D.C., Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Weld up to ½" plate using ¼" rods. Built-in air-cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-lo switch and dial control gives wide range of welding heats. Run welder at 2600 rpm. with tractor, jeep or 10 hp. gas engine, or 7 hp. elec. motor. Complete with instructions, guar. and double V belt or flat pulley. Wt. 110 lbs.
A $400 value at..... **$99.75**
WELDING KIT. Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at.... **$10.50**

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Comb: 2-40 ft. and 1-20 ft. (total 100 ft.) **$4.95**
100 foot length (one piece)..... **$4.85**
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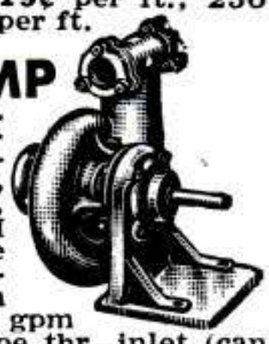

(Item 56) **210 gal. per min.** Centrifugal turbine type. Unexcelled for fire-fighting, irrigation, sprinkling systems, swimming pools, drainage, fuel transfer, etc. Built by GM for the army at cost of more than $145. Tremendous volume, will deliver 210 gpm with 5.3 hp. down to 40 gpm with 1½ hp. 2½" stand. pipe thr. inlet (can be reduced to 2" if desired). Twin 1¼" outlets, dynamically balanced, ¾" shaft, hi-speed ball bearings. Easy fast priming. (instr. incl.) Wt. 36 lbs.
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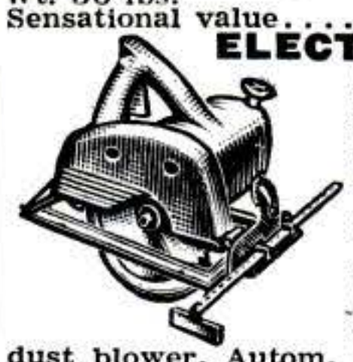

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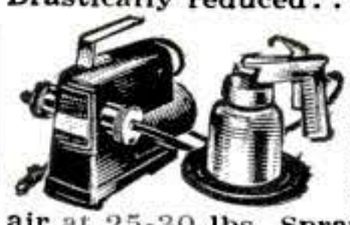

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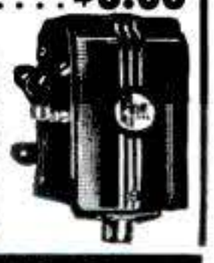

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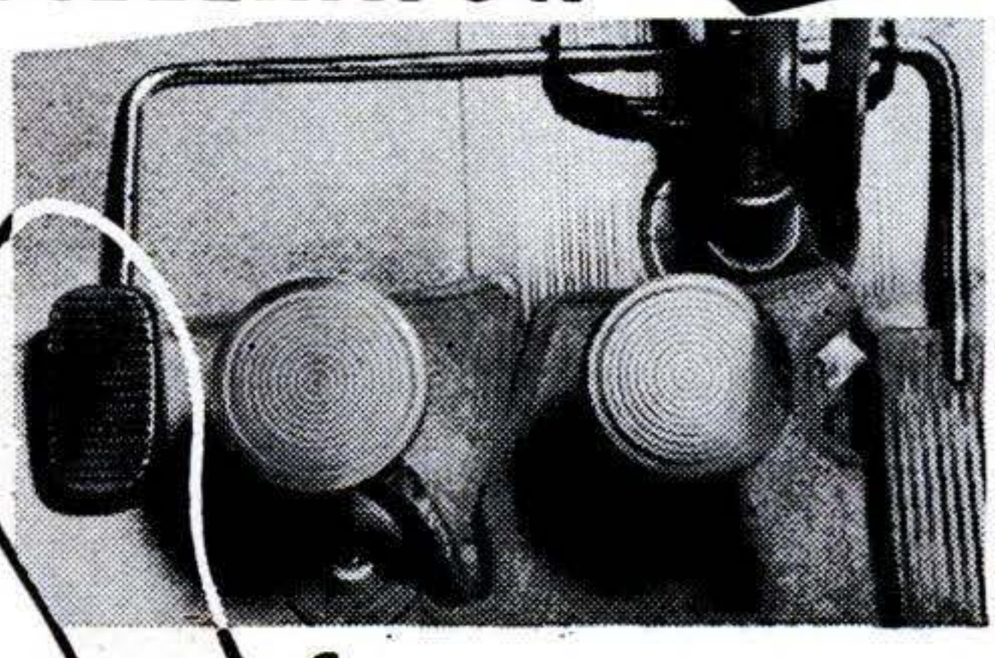

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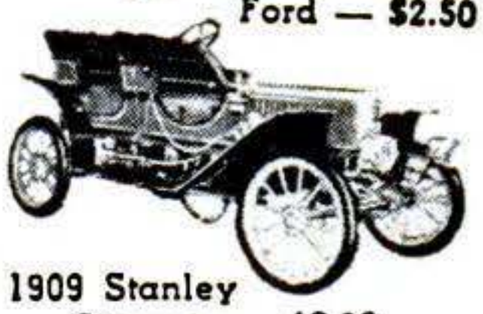

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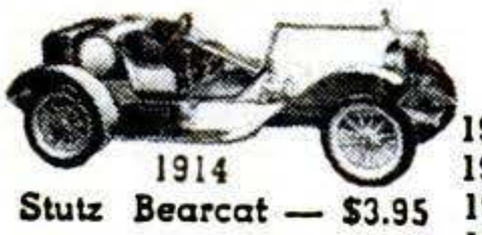

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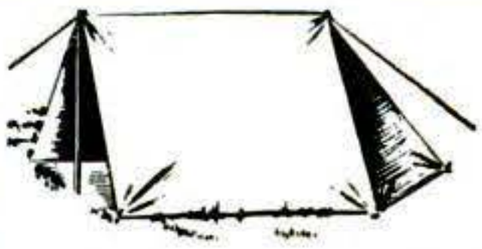

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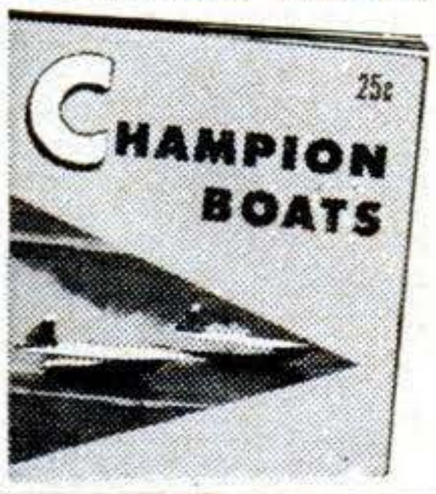

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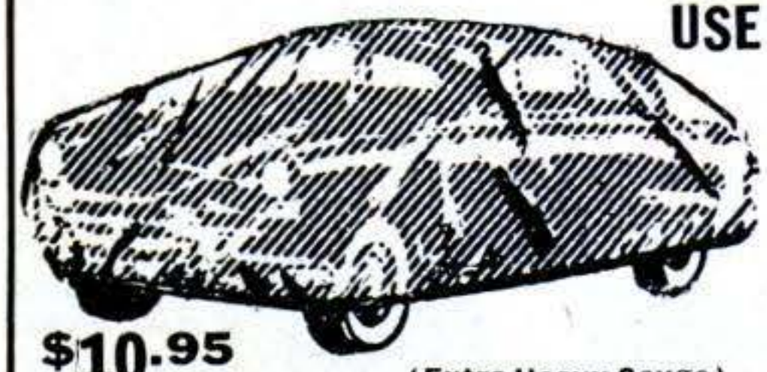

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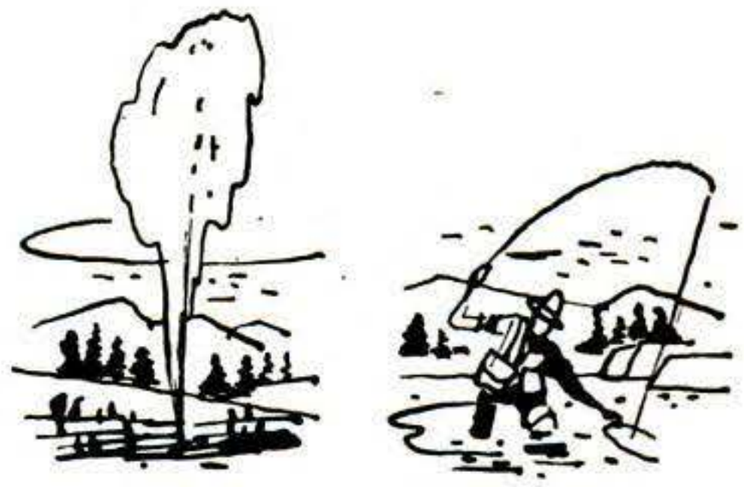

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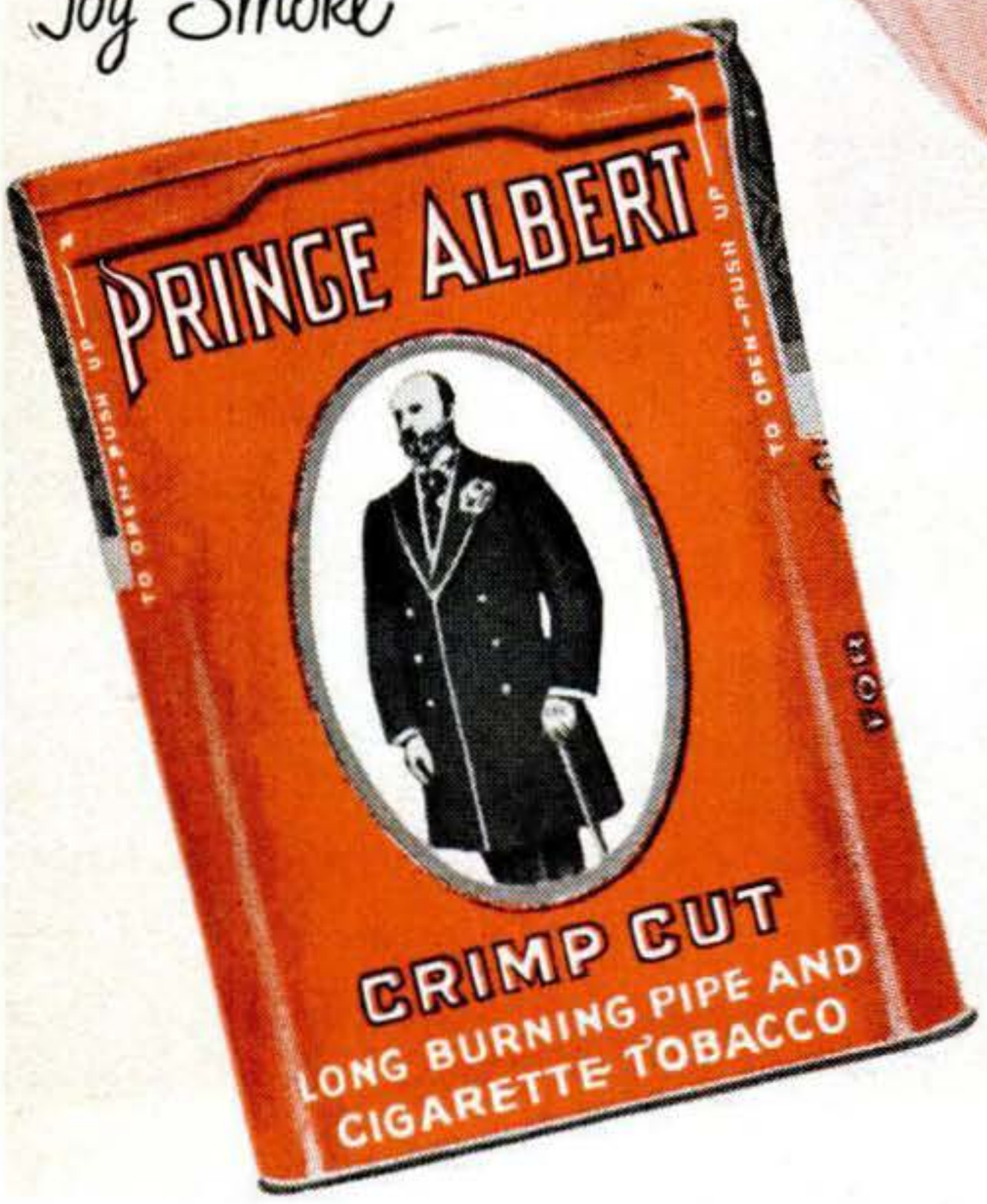

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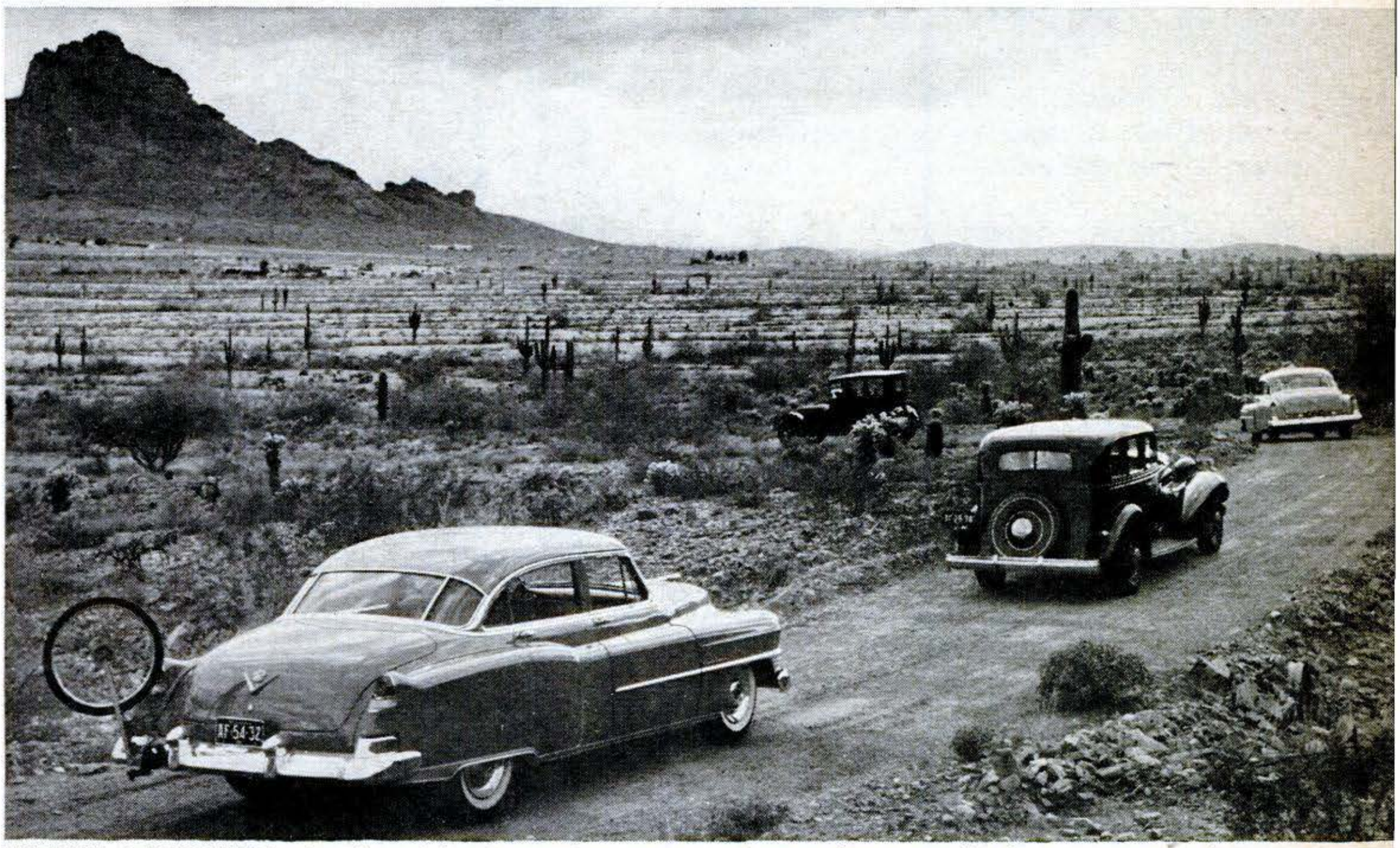
Popular Science *Highlights* This Month

GUS WILSON is completing his 25th year in POPULAR SCIENCE this month. So his friends baked a cake. Here's Gus handing the first piece to Alfred P. Lane, who put him in charge of the Model Garage a quarter of a century ago. Mr. Lane has retired from the automobile business, but Gus is still solving mechanical mysteries. You'll enjoy reading how . . .

Gus Is Saved by a Straw . Page 142



NEW ENGINE developed by General Motors is in car in foreground. This test run in Arizona desert was made to compare its performance with that of 1915, 1935, and 1951 Cadillac engines. You'll find more pictures on Page 100. And you'll also want to read . . .

Shaw Drives Two Luxury Cars 62
$2,000,000-a-Mile Highway 69
German Cars Make Comeback 76
How Trailer Brakes Work 103
How to Fix a Flat 137
Extra Lights for Your Car 149

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Wreckproofing the Railroads

Tragic accidents have caused big lines to adopt safety devices that take human error out of the engine cab—for keeps.

By Alden P. Armagnac

YOU could ride a 60-m.p.h. train for more than 25 centuries before the law of averages would condemn you to a fatal accident, a statistician once calculated. He used the figures for 1949; that year, the railroads set an all-time record for safety.

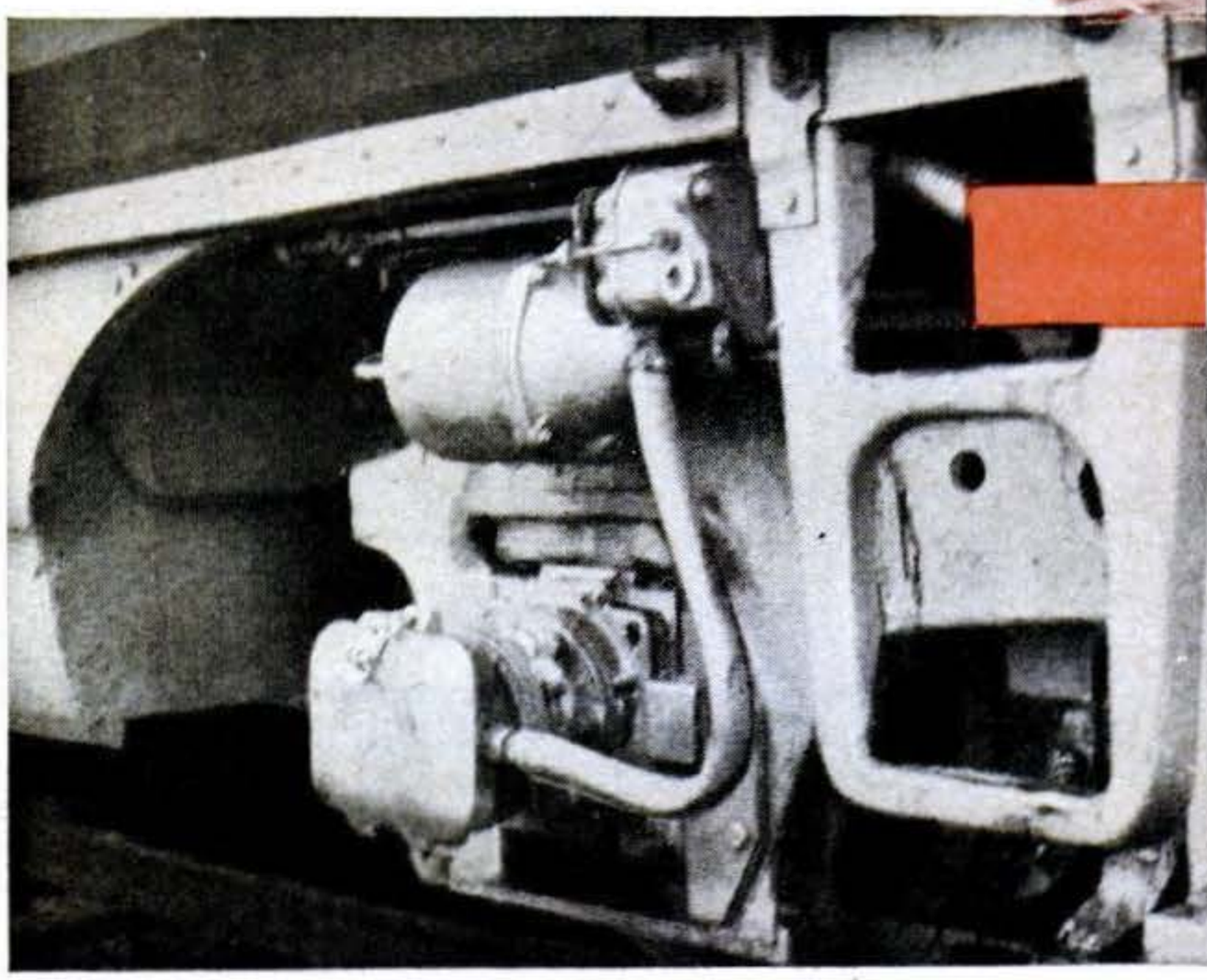
Then, last year, disaster struck. Three major wrecks contributed to a toll of 149 passengers killed. Compared with the total mileage that passengers rode on trains, it was the blackest record in decades.

As a result, automatic speed control for trains is about to be applied on the largest scale in railroading history.

Its purpose is to compel obedience to speed-limiting block signals.

Its key device is a speed governor attached to a locomotive axle.

Its outstanding feature is that it is beyond an engineer's control; all other safety systems leave him some discretion.



Three-speed governor on locomotive axle is key device of automatic speed control. Pennsylvania program will equip 307 Diesel, electric, and steam locomotives for this system.

If your train passes a signal calling for reduced speed, and your engineer should fail to comply, this system will automatically apply the brakes until your train is slowed to safe speed. There is no way to prevent it from acting, except by obeying the signals.

The Pennsylvania Railroad is adopting automatic speed control on 1,300 miles of

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lines, including its New York-Washington and Philadelphia-Pittsburgh routes—by far the largest installation ever undertaken. And it's going in simultaneously on the Long Island Rail Road, world's most heavily traveled commuting line. Both lines will complete their installations as soon as they get the equipment from the Union Switch and Signal Company, of Swissvale, Pa.

Automatic speed control has been in successful use for years on half a dozen U. S. lines. The Chicago and North Western is credited with the biggest installation —500 miles between Chicago and Omaha.

Largest installations of rival safety aids have been 2,717 miles of "automatic train stop" on the Southern, 1,031 miles of the same system on the New York Central, and

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1,259 miles of "cab signaling" on the Pennsy.

With its own members unable to agree on which system was best, the Interstate Commerce Commission left the choice to the railroads in 1947, when it ordered all lines to have the following safety equipment installed by the end of 1952:

1. Block signals where passenger trains exceed 60 m.p.h.; freights, 50 m.p.h.

2. Cab signaling, automatic train stop, or automatic speed control where passenger trains exceed 80 m.p.h.

Let's look into each one of these:

Block signaling divides a line into short lengths, or blocks, with a signal at the entrance to each. Modern automatic block signals are electrically operated by the trains themselves. As many as four signal "aspects," showing whether three, two, one, or no blocks ahead are clear, set corresponding speed limits for safety. On the Pennsy, *Clear* permits maximum speed; *Approach-Medium,* 45 m.p.h.; *Approach,* 30 m.p.h.; *Stop-and-Proceed,* the fourth aspect, guards an occupied block; an oncoming train must stop, but may then proceed at 15 m.p.h., prepared to stop short of another train.

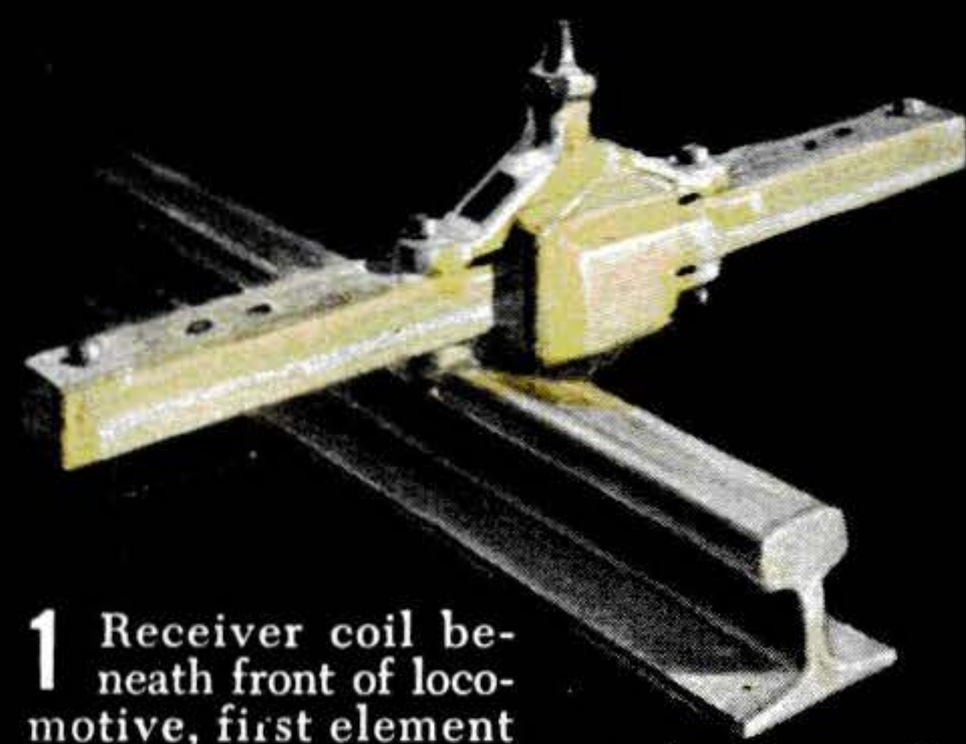
"High-Speed" Safety Systems

Cab signaling, showing block signals on a miniature panel, brings the signals right into the cab so that neither fog, smoke, nor a moment of inattention can prevent the engineer from seeing them. When a signal calls for reduced speed, a whistle in the cab blows until the engineer presses an "acknowledging lever." It's left to him to obey the signal. But if he fails to "acknowledge," the unchecked whistling should warn a fireman or other trainman to see if he's stricken with illness.

Automatic train stop combines cab signaling with an added safeguard. Unless an engineer promptly "acknowledges" a reduce-speed signal, it applies the brakes and stops the train. But an engineer could still "acknowledge" and disobey a stop signal.

Mechanical "trippers" act more decisively. They work well in subways and in railway tunnels, but are rarely used outdoors, where ice makes them unreliable. A stop signal raises a trackside mechanical arm that engages a trigger beneath a passing train, applying its air brakes and jerking it to a none-too-gentle stop. To keep this from happening, a motorman must halt short of the signal. He may pass a

SPEED CONTROL PROMISES "MANPROOF" RAILROAD SAFETY

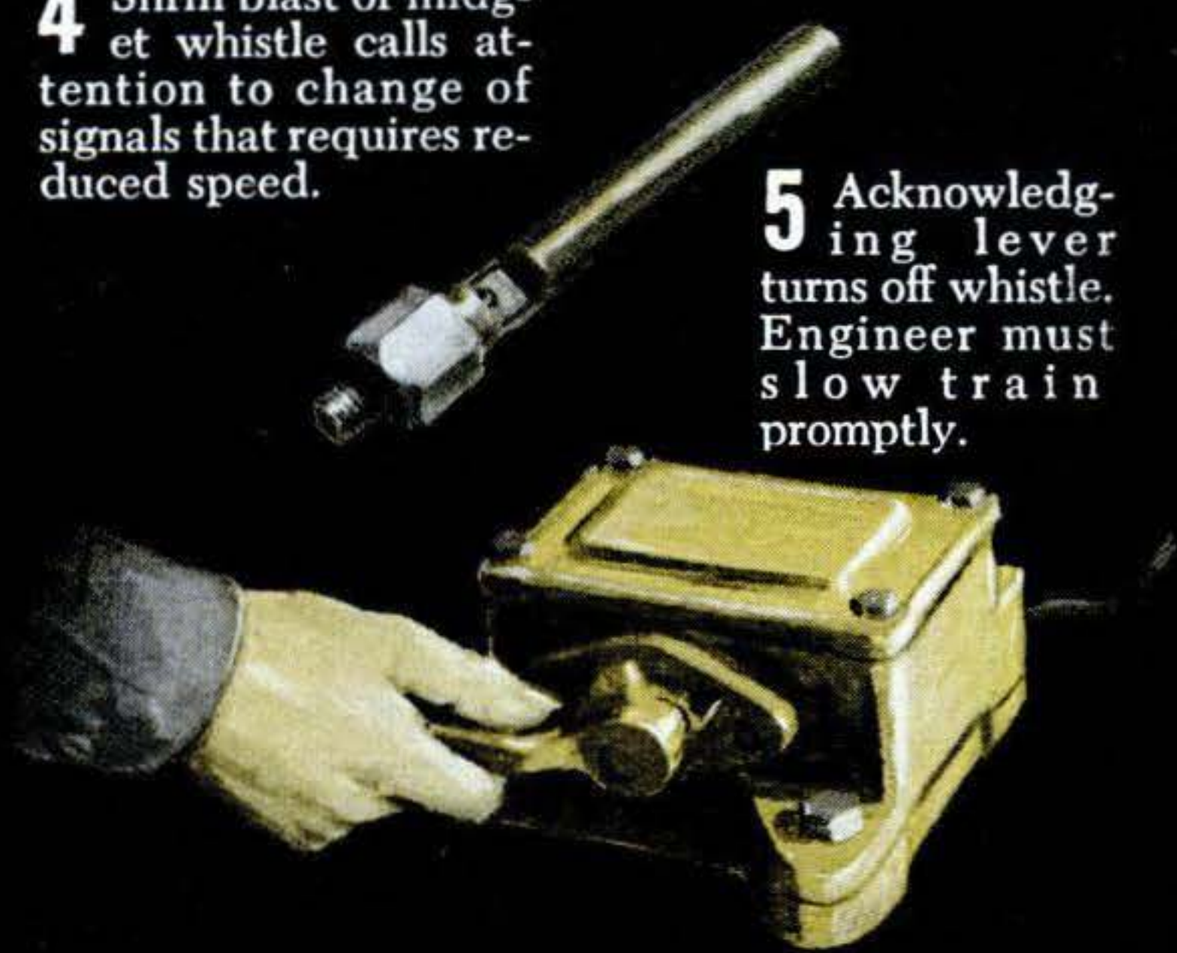


1 Receiver coil beneath front of locomotive, first element in Pennsylvania's speed control, picks up electric signal impulses from rail by induction.

2 Electric "brain" on locomotive interprets signal impulses, coded by number of interruptions per minute for different aspects, and lights correct cab signal.

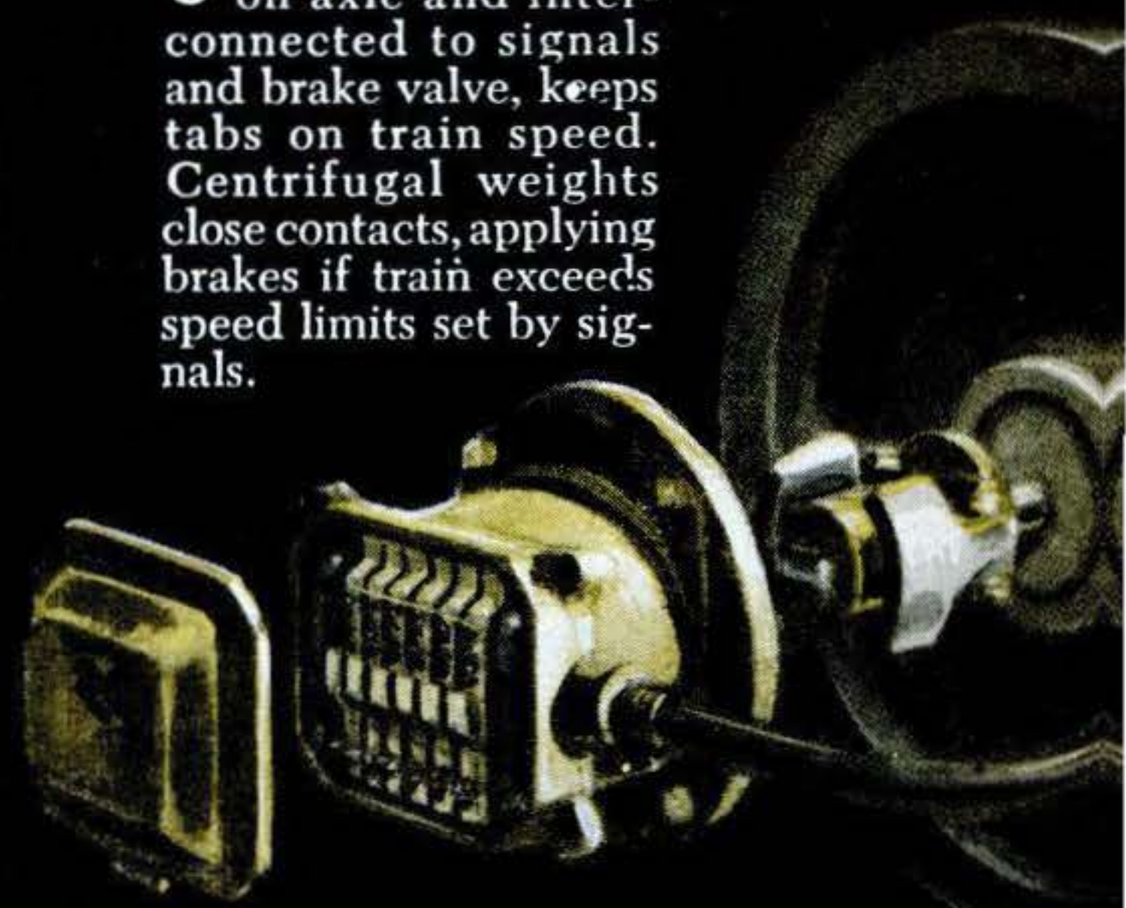
3 Cab-signal panel reproduces each wayside signal passed, so that engineer of train cannot fail to see it. Top window shows *Clear;* next two, *Approach-Medium;* next one, *Approach;* bottom one, *Stop-and-Proceed.*

Engineer of Pennsylvania electric locomotive sees wayside *Clear* signal through cab window and then on panel at left as train passes signal. Equipment shown is for cab signaling. Scene will be same with speed control, since extra equipment is installed outside range of this view.



4 Shrill blast of midget whistle calls attention to change of signals that requires reduced speed.

5 Acknowledging lever turns off whistle. Engineer must slow train promptly.



6 Governor, mounted on axle and interconnected to signals and brake valve, keeps tabs on train speed. Centrifugal weights close contacts, applying brakes if train exceeds speed limits set by signals.

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FIVE WAYS OF SAYING "STOP"

SEMAPHORE

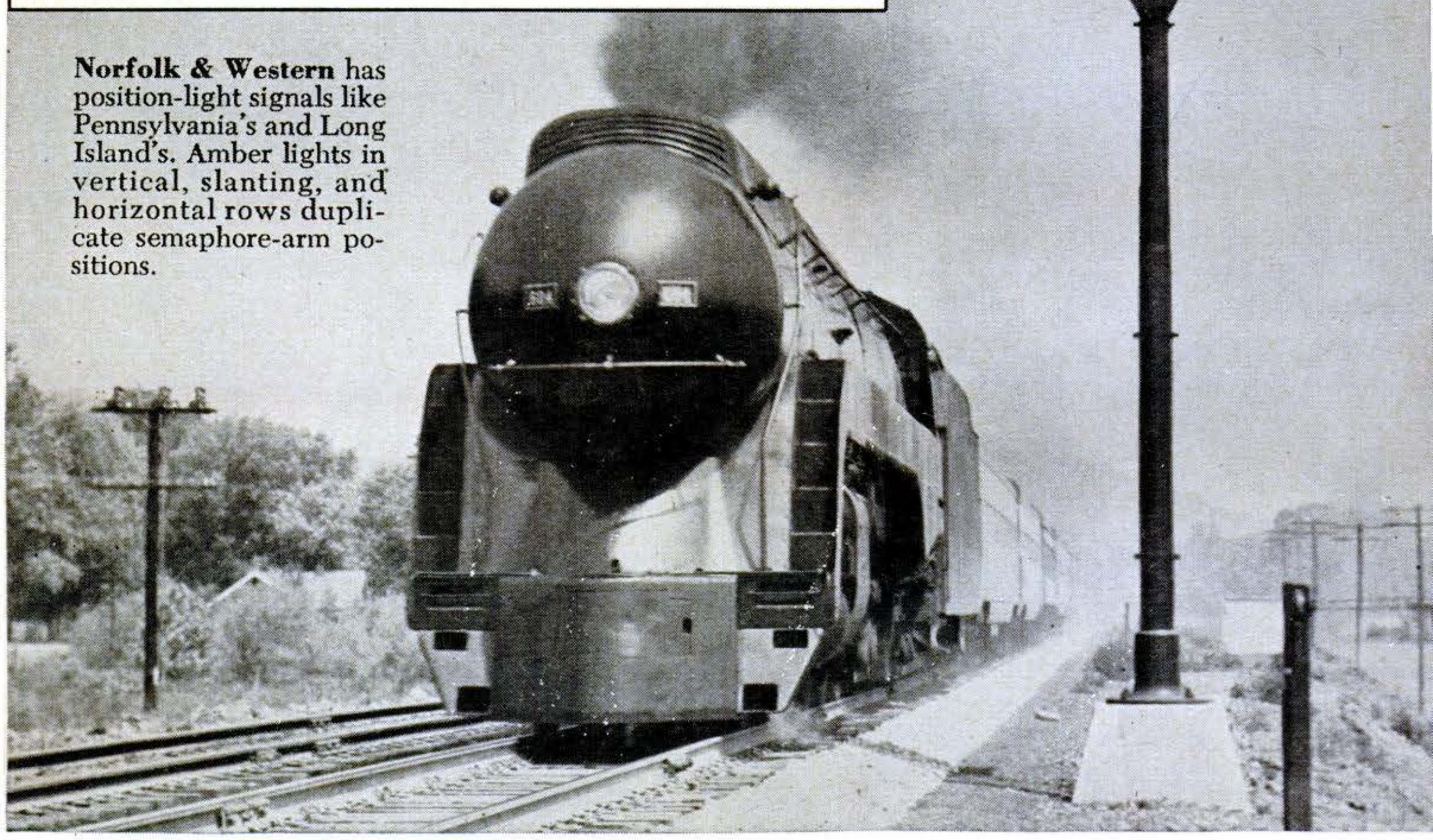
SEARCH-LIGHT

COLOR LIGHT

POSITION LIGHT

COLOR-POSITION LIGHT

Here are styles in block signals. Lights are replacing semaphore arms for better day-and-night visibility.



Norfolk & Western has position-light signals like Pennsylvania's and Long Island's. Amber lights in vertical, slanting, and horizontal rows duplicate semaphore-arm positions.

stop signal, however, by "keying by." Depending upon the type of installation, that may mean getting out of the cab and inserting a key in the signal, or merely stopping at it first and then starting up again—an "automatic key-by."

This leaves automatic speed control the only completely "manproof" safety system. In the Pennsy's typical version, it will enforce the three block-signal speed limits of 15, 30, and 45 m.p.h. Electrical contacts in the governor close, successively, as a train reaches each of these speeds. The governor is interconnected with cab signals and air-brake valve through an electric "brain." If train speed (shown by the governor) exceeds permissible speed (shown by the signals), the electrical hook-up automatically actuates the brake valve until they jibe. On Diesels and electrics it also cuts power to prevent overloads, but this is unnecessary on steam locomotives.

To cause a collision, an engineer would have to pass by a *Stop-and-Proceed* signal.

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At this restricted speed of 15 m.p.h. (12 m.p.h. on the Long Island), any collision would be far less serious than at higher speeds. And since a slow-moving train can be stopped in less distance than a speeding one, an engineer, having once spotted danger ahead, could probably avert a collision completely by stopping in time.

Is so rigid a system best? Opponents gloomily foresaw "intolerable delays" unless safety systems trusted to an engineer's judgment, after warning him.

Then, last year, two Long Island Rail Road trains met in a crash on a "gantlet" track near Rockville Centre, N. Y., and 29 passengers died. The Pennsy's crack "Spirit of St. Louis" rammed a stalled troop train near Coshocton, Ohio, and 33 soldiers were killed. The rear-end collision of two Long Island trains at Kew Gardens, N. Y., last Thanksgiving Eve, took 78 more lives.

These lines had cab signaling, linked to automatic block signals—all found to be in perfect working order.

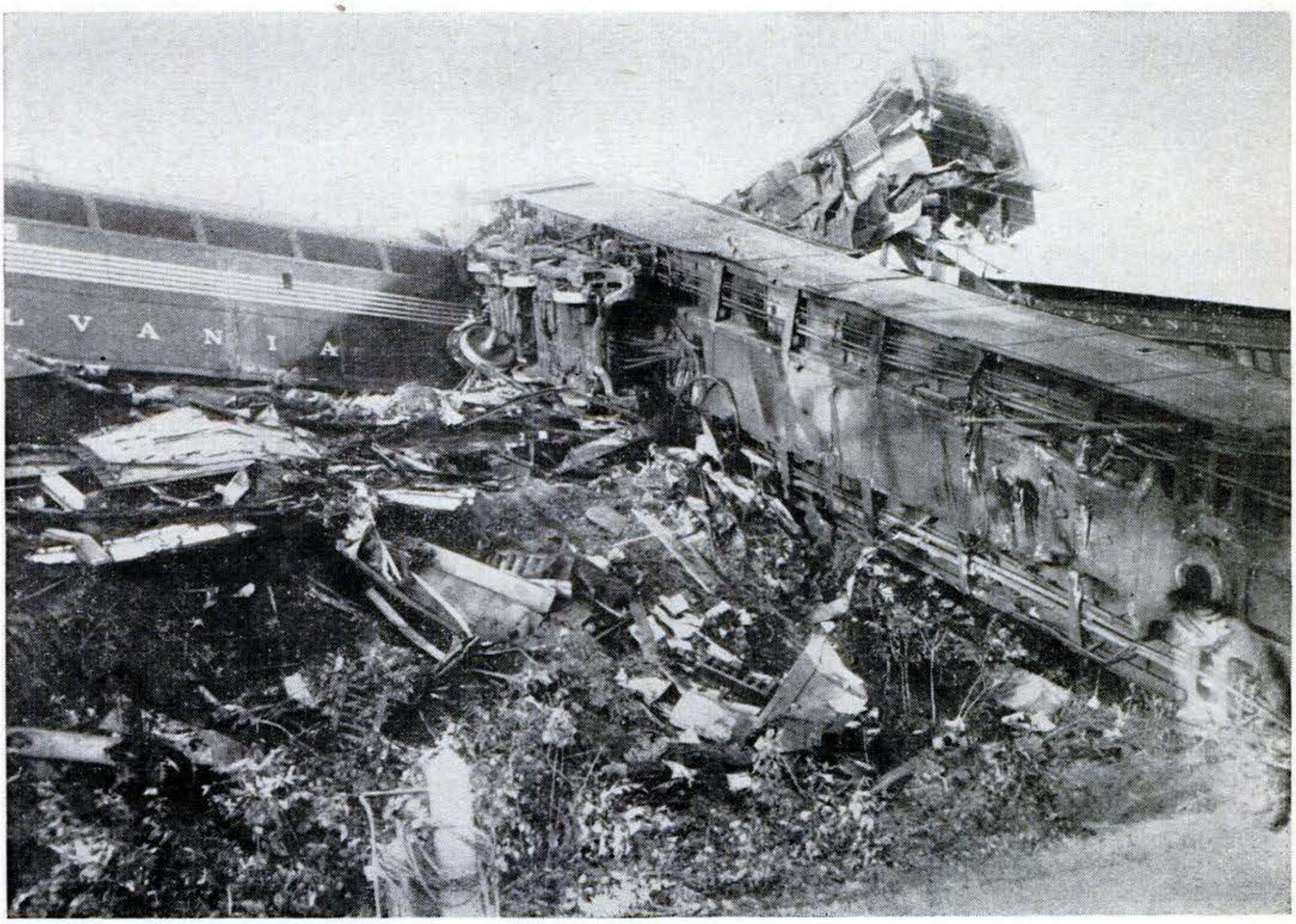
Stop signals hadn't even halted the trains causing the first two wrecks. In the Thanksgiving Eve tragedy, the engineer at fault did obey a stop signal. Then, speeding up instead of proceeding cautiously, he hurtled into the train ahead. Subway-type "trippers," with their key-by feature, would have let him do the same.

Automatic speed control would have made all of these crashes less serious—or averted them completely.

And with a simple electric connection to a temporary track at Woodbridge, N. J., it could have enforced reduced speed and saved 84 lives lost when a speeding Pennsy train jumped a curve there early this year.

It will protect passengers from an engineer's disregard of danger signals, whatever the explanation—sudden illness, flagrant inattention, human temptation to take a chance. It will protect enginemen themselves, a Public Service Commission report on the Long Island adds, from any possibility that superiors might encourage or wink at rule-breaking to keep trains on time.

Despite great safety advances of the past—the dead-man's button, block signals, cab signaling—the unpredictable human factor has remained. Now automatic speed control, eliminating it, will do for human beings what they can't do for themselves. END



Barreling past stop signal and frantically waving flagman, "Spirit of St. Louis" crashed at 48 m.p.h. into troop train stalled by broken air hose, killing 33 soldiers. Investigations found only automatic speed control could have averted recent wrecks due to human failure.

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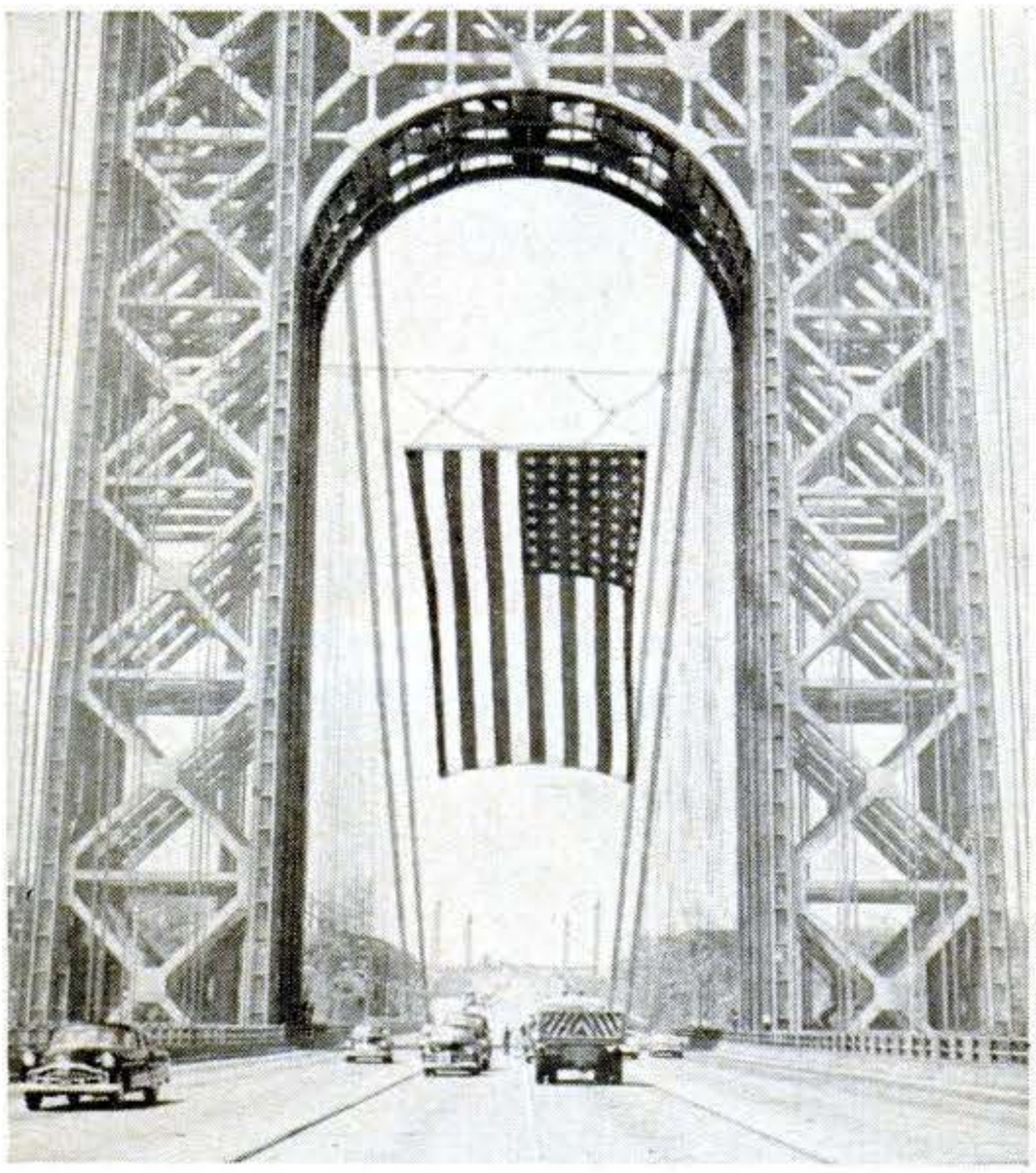
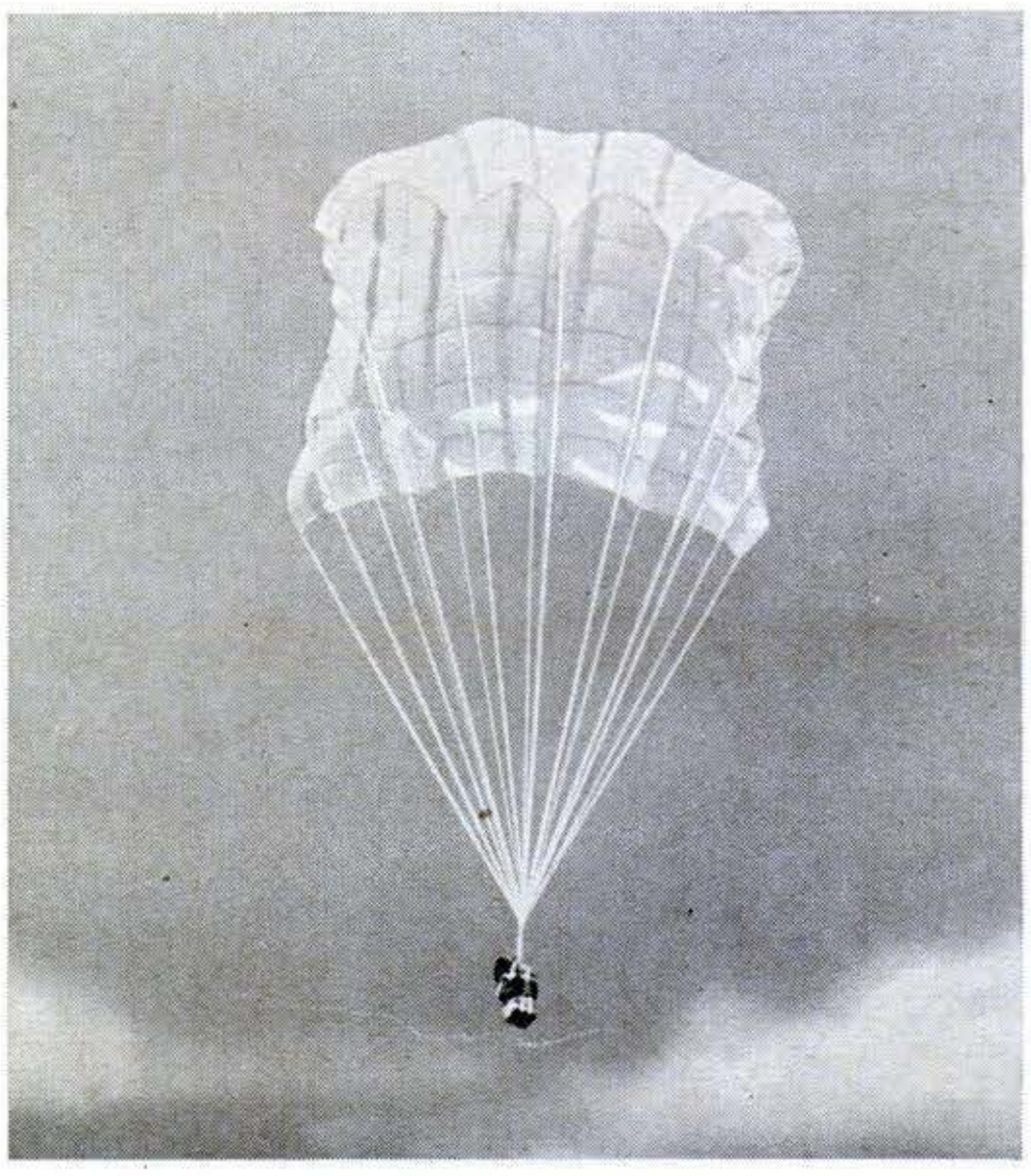
French Car Has U. S. Look

THE Detroit look is going to Paris. American lines mark the new French Simca 9 Aronde, a four-seater that can reach a top speed of 75 m.p.h. The four-cylinder, valve-in-head engine develops 45 horsepower at 4,000 r.p.m., with a displacement of 75 cubic inches. It also boasts a cooler for the crankcase oil. Gas mileage is about 30 miles to the gallon.



Big Bridge Flies Biggest Flag

WHEN a big bridge honors a big holiday, it needs a big flag. And that's just what New York's huge George Washington span uses on special occasions—a 385-pound, 60- by 90-foot American flag, believed to be the world's largest. Cables hold the heavy banner against the high winds that continually whistle through the bridge's tall towers.



Cheap Cotton 'Chute Drops Heavy Load

THIS parachute is just long strips of cheap cotton muslin taped together to form a square. But it carries twice the cargo of previous Air Force 'chutes, and costs half as much. It safely drops a 500-pound load from a plane traveling 175 m.p.h. Secret of its strength are the spaces between strips, which let some air escape and cut shock.

Plane Treads Over Rocks

YOU wouldn't even need a smooth cow pasture to land a lightplane equipped with this tank-track type of undercarriage. It will put a plane safely down on extremely rough terrain, says the inventor, Italian Count Giovanni Bonmartini. These tracks (right) are similar to those tested by the U. S. Air Force on bigger planes.

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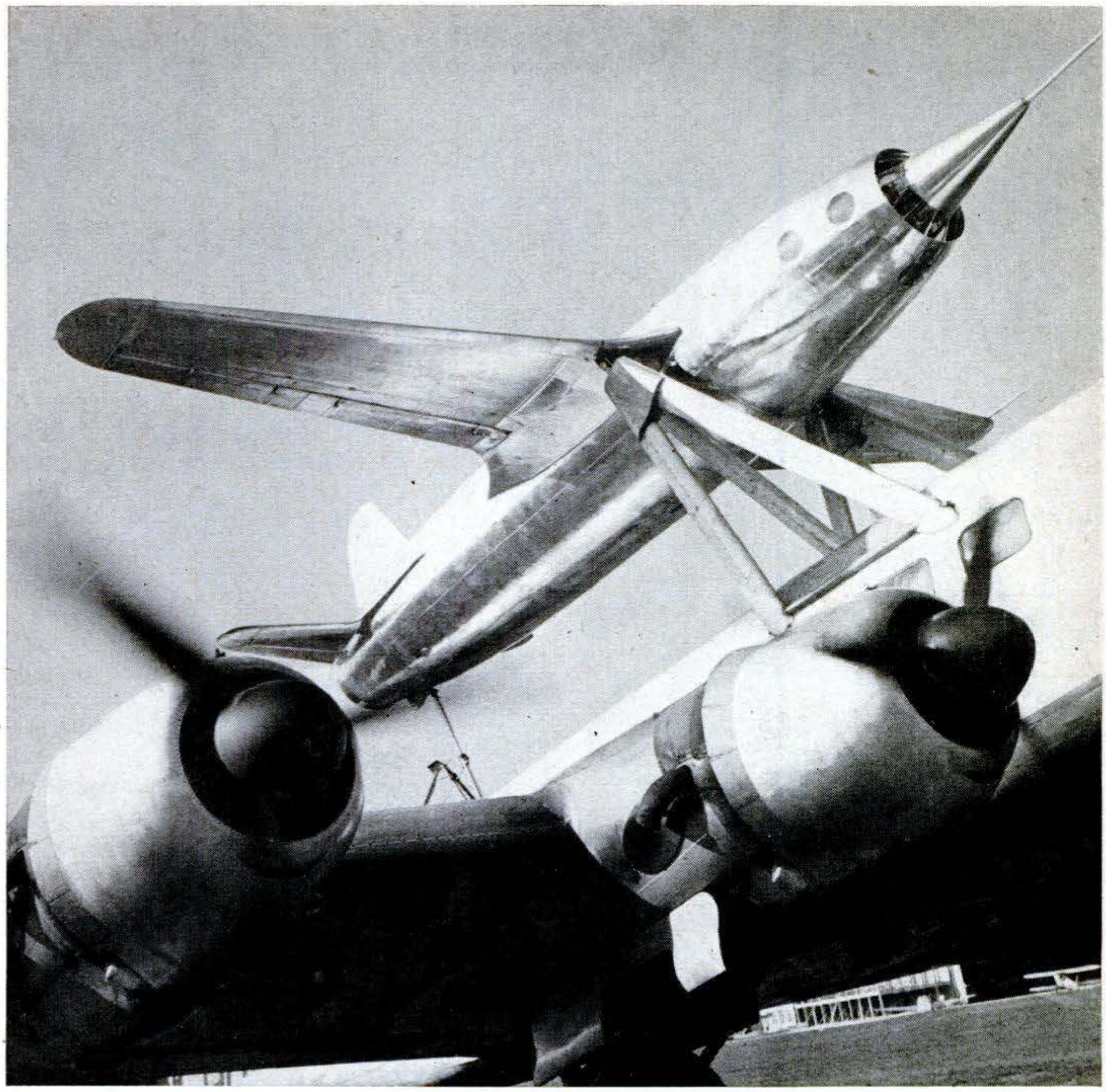

Leduc ramjet perches atop prop-driven "mother" plane that launches it at 200 m.p.h. Another version, with retractable landing gear, uses two turbojets to get ram up to operating speed.

Pilots Sit Inside Engine of New Ramjet

A CREW of two men sits in a streamlined cockpit inside the engine of a ramjet airplane being flown in France. The engine—the simplest known to flying—is just a tube in which squirted fuel burns, creating gas that shoves the plane ahead. The speeding plane itself scoops up air for combustion (PS, Jan. '49, p. 130).

The air duct of the engine is a part of the fuselage, but combustion occurs behind the cockpit. The pilots can see out past a cone at the duct entrance and through side windows. In an emergency, the entire front end of the plane, containing the crew, falls away and is lowered by parachute.

Rene Leduc, who designed the aircraft for the French Ministry of Air, says that planes of this type are capable of flying 3,000 m.p.h. A ramjet engine, however, must attain high initial speed by some auxiliary power before it can operate by itself.

Collapsible Tube 100 Years Old

FIRST collapsible tube, forerunner of tooth-paste and shaving-cream containers, was patented in 1841. Collapsible aluminum tubes, however, weren't made in America until 1920.

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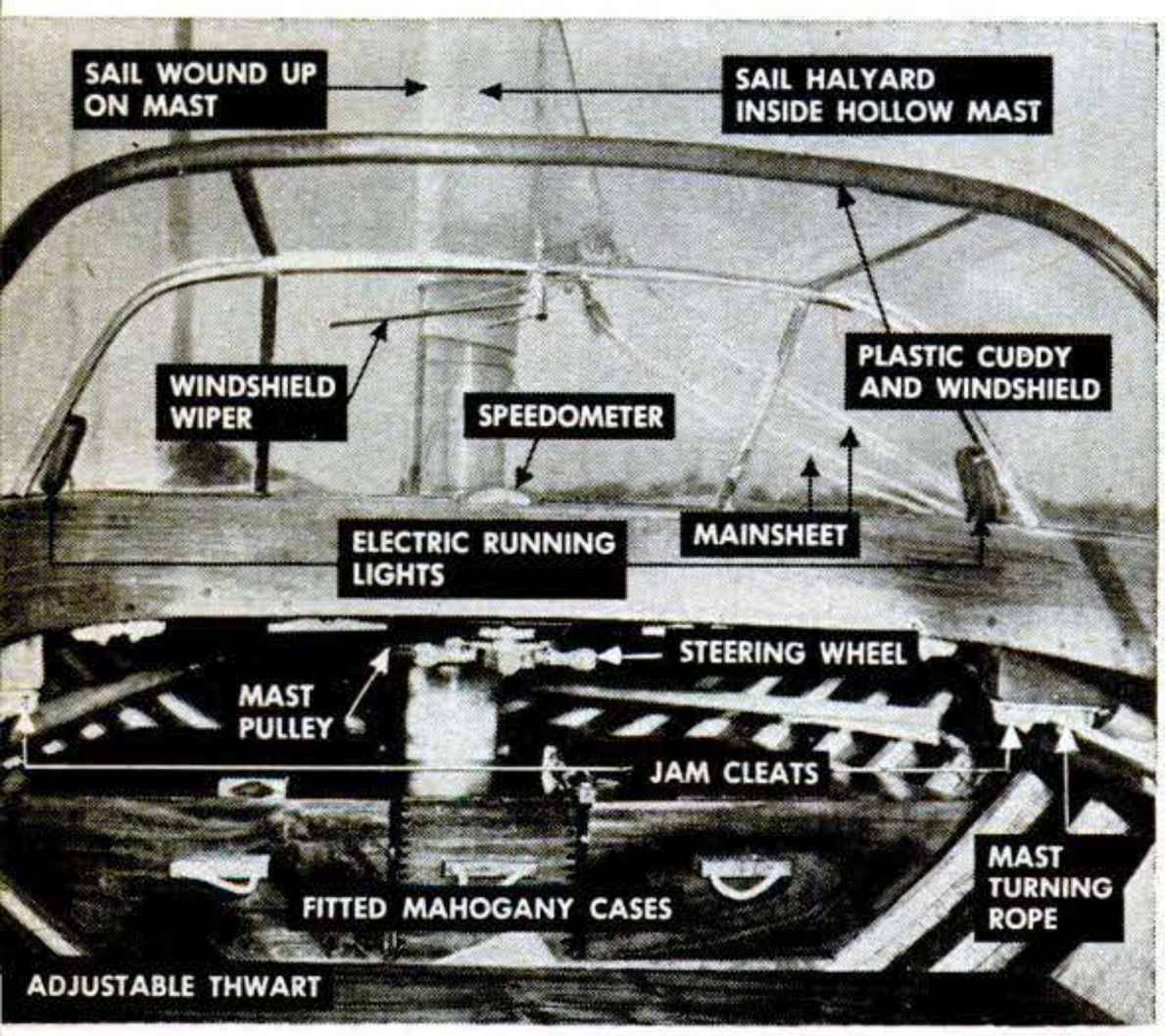
Roller Mast Takes the Sweat Out of Sailing

Teamed with double sail in unusual Swedish Twin Wing, this mast provides a rig that's tops in ease of handling.



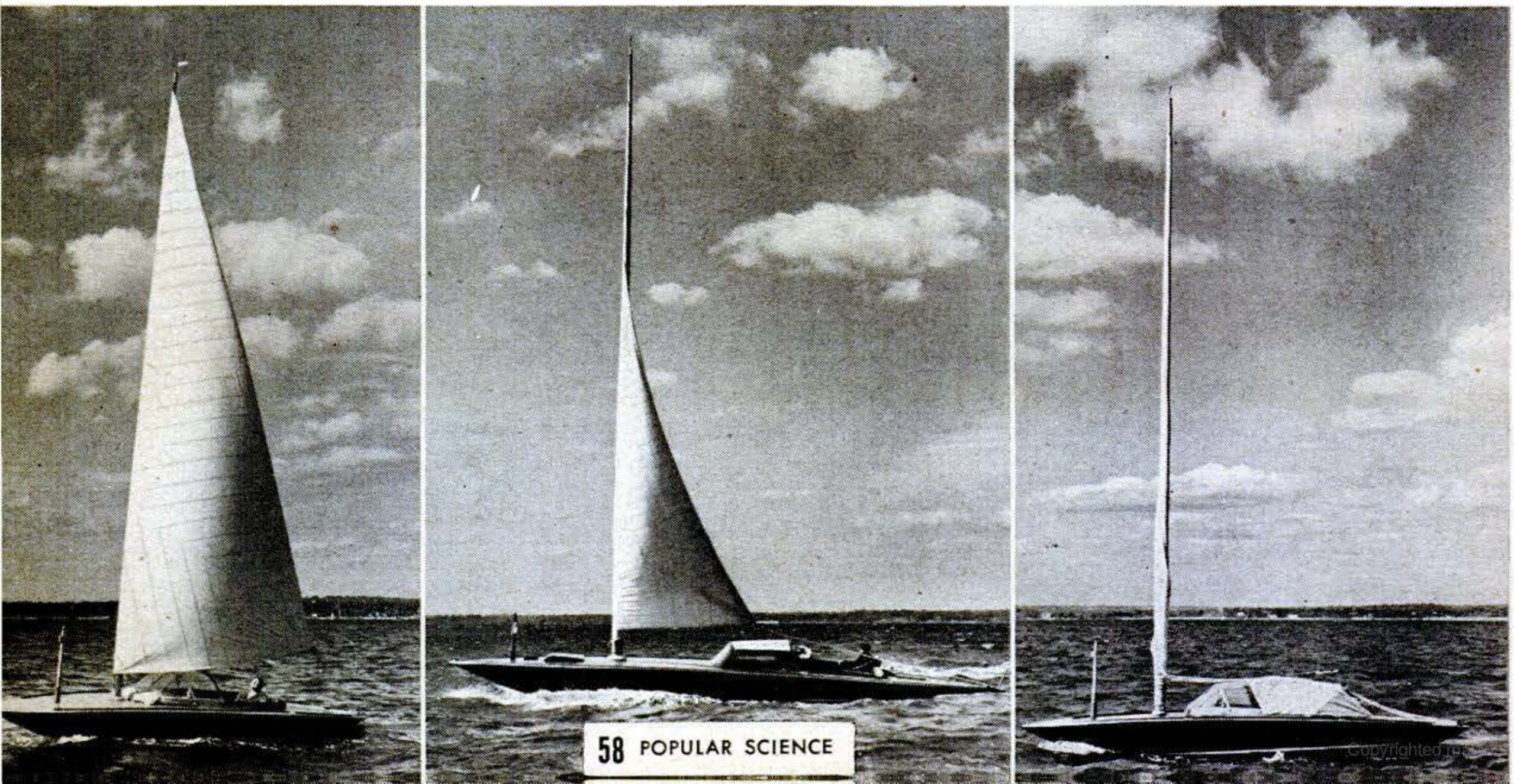
Cockpit has clear-plastic shelter (called a "cuddy") and canvas top like convertible auto. Wiper is hand-operated. Seats adjust for heel. There's also standard tiller in sternsheets.

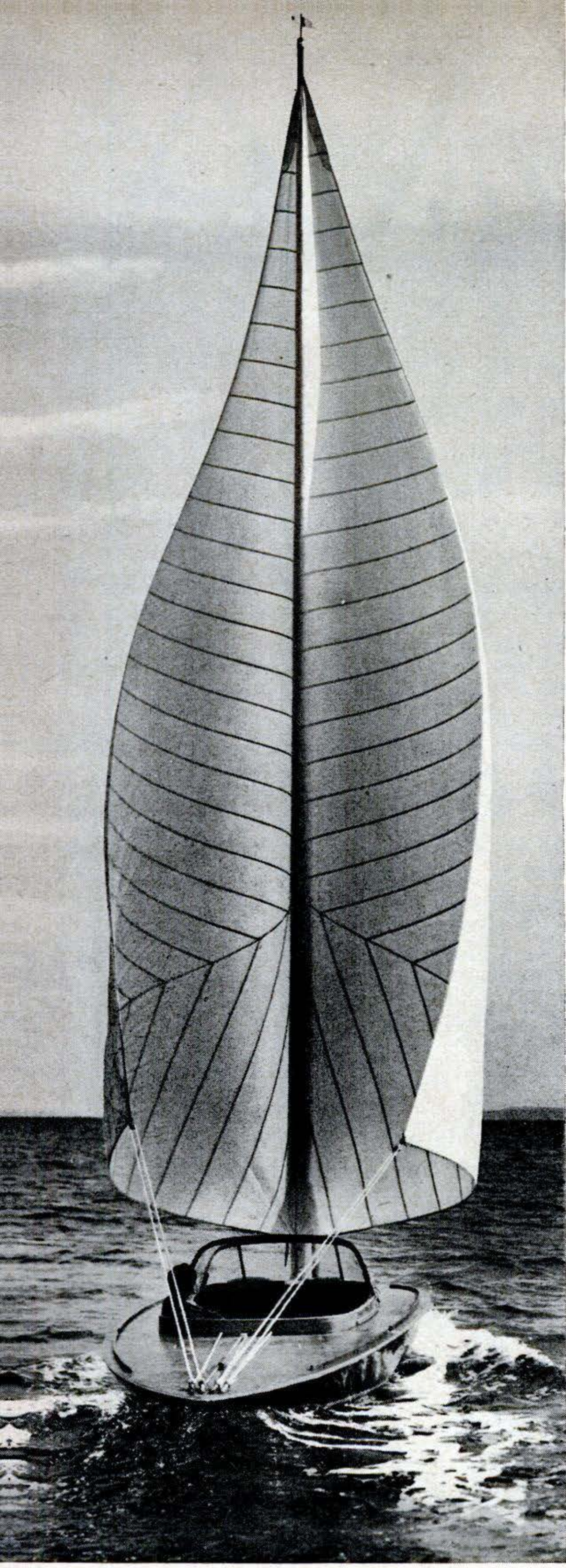
THE minute you step aboard, you see this craft is different. The cockpit has the feel of your car's front seat. But when you get underway the real surprises begin.

No hauling off sailcover, untying stops, straining at halyards. Instead, the skipper casually pulls the sail out from the mast like a window shade set on end. While you're out a squall comes up and you have to shorten sail. No hurried fumbling—the window shade is just wound up part way. Later, you swing before the wind—and miraculously the mainsail doubles! A chill rain starts, but the skipper raises his convertible top and handles her entirely from the cockpit. And back at the mooring he just winds in the sail around the mast—and goes home.

That's sailing, the way you do it in the latest thing from Sweden—the Twin Wing 155. Designed by Dr. Fredrik Ljungstrom to be safe, simple, and highly maneuverable, the 23-foot sloop dispenses with stays, boom, and foresails, and uses a mast that spins on its heel. The Twin Wing mainsail is really two identical loose-footed sails sewn together at the luff, the edge toward the mast. Going to windward, the two parts are doubled to act as a single 155-square-foot mainsail. With the wind aft the two parts open up of their own accord to provide a parachute spinnaker, doubling the

Close-hauled Twin Wing, left below, looks like catboat. You reef, center, by winding in part of sail (craft shown is 44-footer). Sail is furled, right, by rolling in completely. No cover is needed: air currents around mast minimize mildew. Sail is hoisted at season's start, lowered at end, by halyards inside hollow mast. Note that deck curves down at ends.





sail area. When the course is changed back to windward the two parts come together again by themselves. There is no danger of jibing, no swinging boom to duck, no backstays to adjust, no jibsheets to tend.

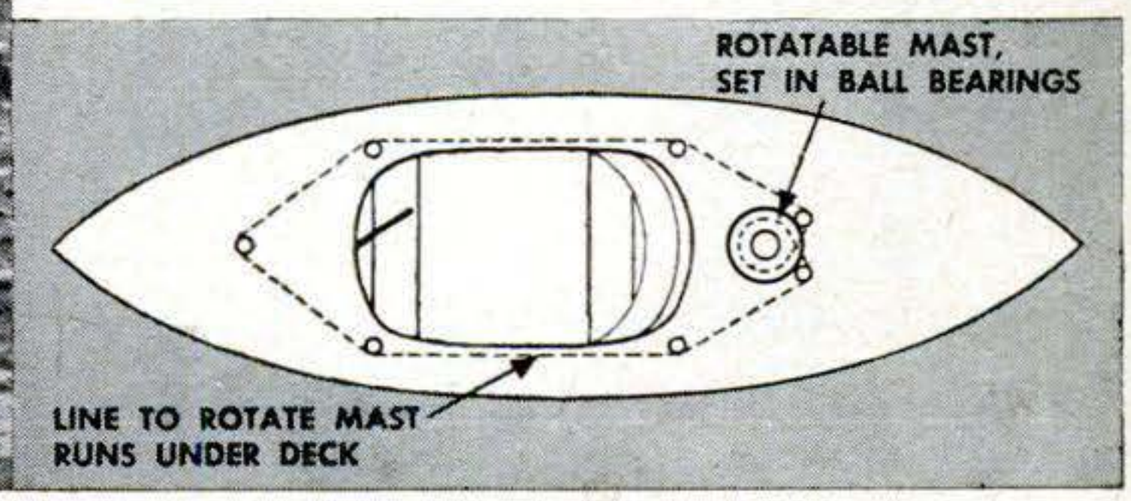
The sail is reefed and furled from the cockpit. All you do is pull on an endless rope wound around a big pulley clamped about the mast underneath the deck beams. This turns the mast, which is supported in two sets of ball bearings—one on the keel and another at the deck. Automatic jam cleats hold the mast-turning rope firmly in place, but the sail can be quickly altered at any time. The boat can get underway or be secured in a matter of seconds, and speed through the water can be as quickly controlled by altering the sail area.

The Twin Wing rig can be used on any hull, but the hull of the 155 imported to this country is also Dr. Ljungstrom's design. The laminated ribs are pre-bent to the same curvature on a circular form. The keel in profile is the long arc of a circle that has its center near the top of the mast. The result is a circular-arc hull without flat or hollow sections. It's not only strong, light, and cheap, but fast, because a minimum of wetted surface keeps down skin friction.

The novel craft has some disadvantages, however. She heels sharply in a light breeze due to her hull shape. She is relatively slow in light winds and on a reach. And she loses the speed gained from the "slot effect" of a jib and mainsail used together. Balanced against these are maneuverability, easy operation, and efficiency.

A larger model, 44 feet in length, with full cruising accommodations for five and an auxiliary engine, is also available in this country through distributor Eric Benson, of Larchmont, N. Y. New to this country, the rugged rig and hulls have been thoroughly tested overseas in gales up to 60 m.p.h. END

Before the wind (left) double mainsail splits to provide spinnaker. No stays are needed, cutting wind resistance. Plan (below) shows how line from roller mast runs around cockpit.



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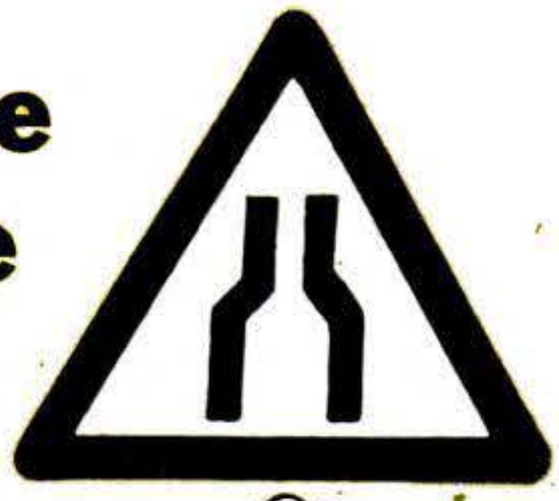
Signs Can Be Same In Every Language

You may see the same road signs in Africa as in Minnesota if the United Nations succeeds in developing uniform markers. In four U.S. states and five foreign countries, observers are testing comparative distances at which motorists can understand two kinds now used: "European" or pictorial style, top row at right, and "U.S." or word style, lower row. If pictures as clear as words can be devised, they'll mean the same in any language.

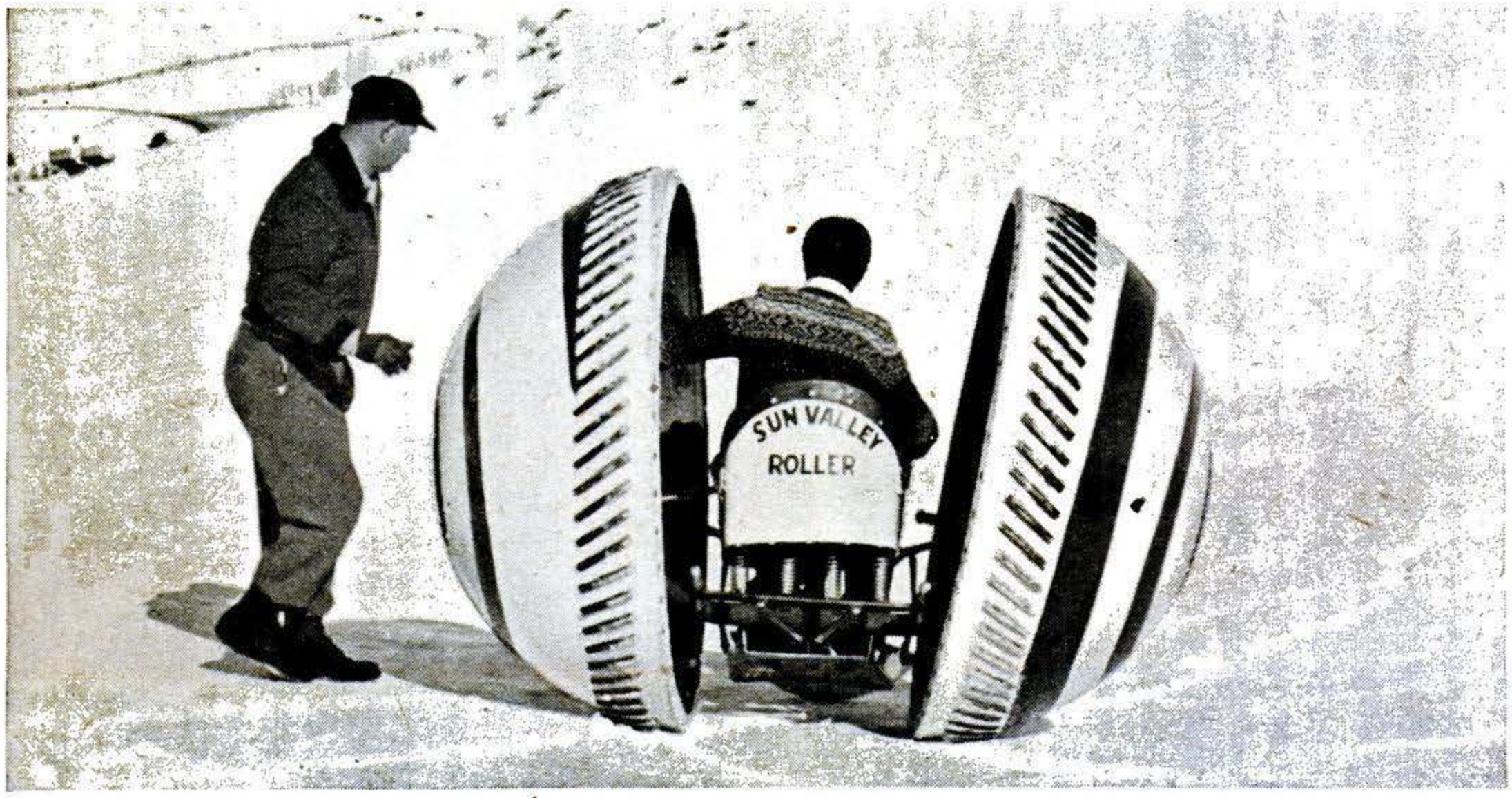


Platinum Makes Small Magnets Strong

PLATINUM, the jewelers' metal, is one of the ingredients that make a new type of midget magnet the world's most powerful for its size. One of these cobalt-platinum magnets the size of a pencil eraser can outlift an equally big Alnico-5 magnet, as shown at left.

Snow Coaster Rolls Down Hill

HERE'S a new way to go coasting. Instead of sliding on runners, the 400-pound aluminum vehicle below rolls on five-foot half-spheres, giving a passenger a thrilling ride down a snow-covered slope at Sun Valley, Idaho. Individual wheel brakes, on handle bars, steer the "mechanical snowball."



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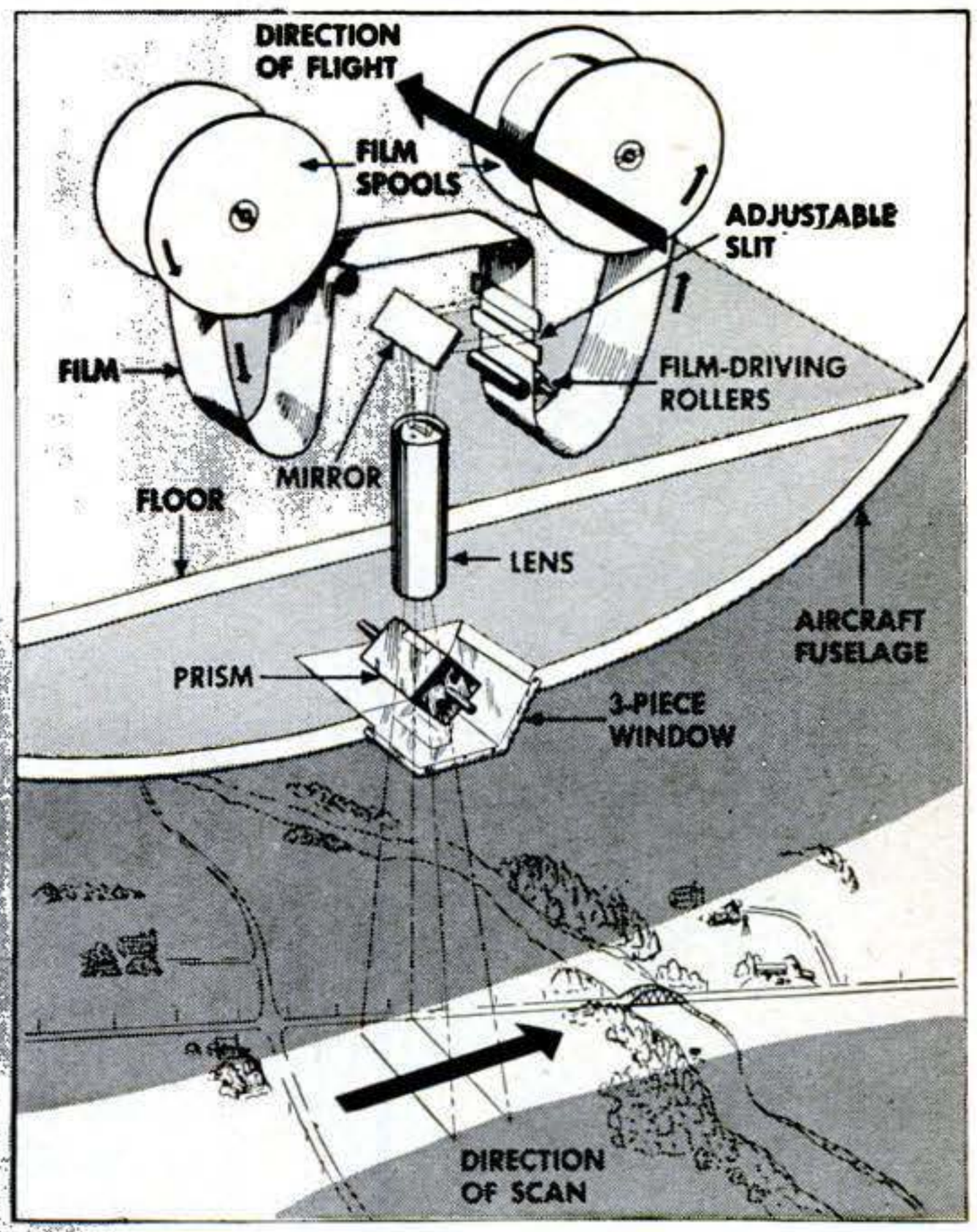
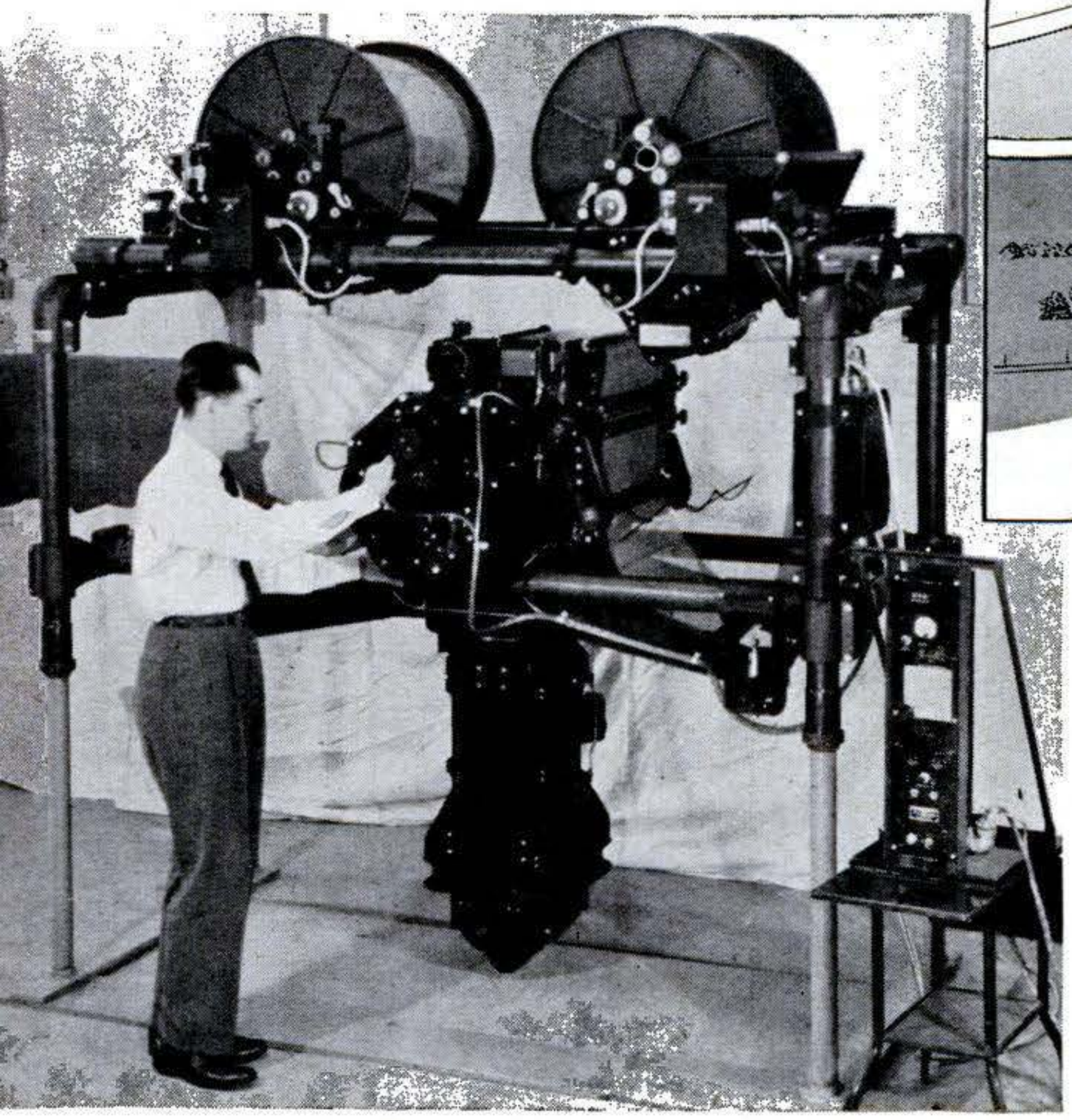
New Camera Catches Everything in Sight

EVERYTHING from horizon to horizon is caught in one sweeping exposure in this new Air Force reconnaissance camera. It could picture all of Pennsylvania on one film roll in a few hours. A moving pair of 90° prisms acts like a mirror. Placed in the camera's line of sight, as at right, it swings back and forth, scanning 180° of countryside in each sweep across the plane's course. During exposure, film moves in synchronism with the prism's sweep.



How panoramic camera works is shown above. Lens of 48-in. focal length peers down through window in belly of plane, where swinging prism (actually a pair of 90° prisms) acts like mirror and sweeps camera's view from side to side. Mechanism moves film in synchronism with scanning. Each picture may be 10 to 12 ft. long.



Camera weighs 1,500 lb. and holds nearly a mile of 18-in.-wide film. First fixed unit able to cover 180°, it contrasts with standard ones limited to 38°. Big lens of f/8 speed has five elements; largest one is 8-in. in diameter.

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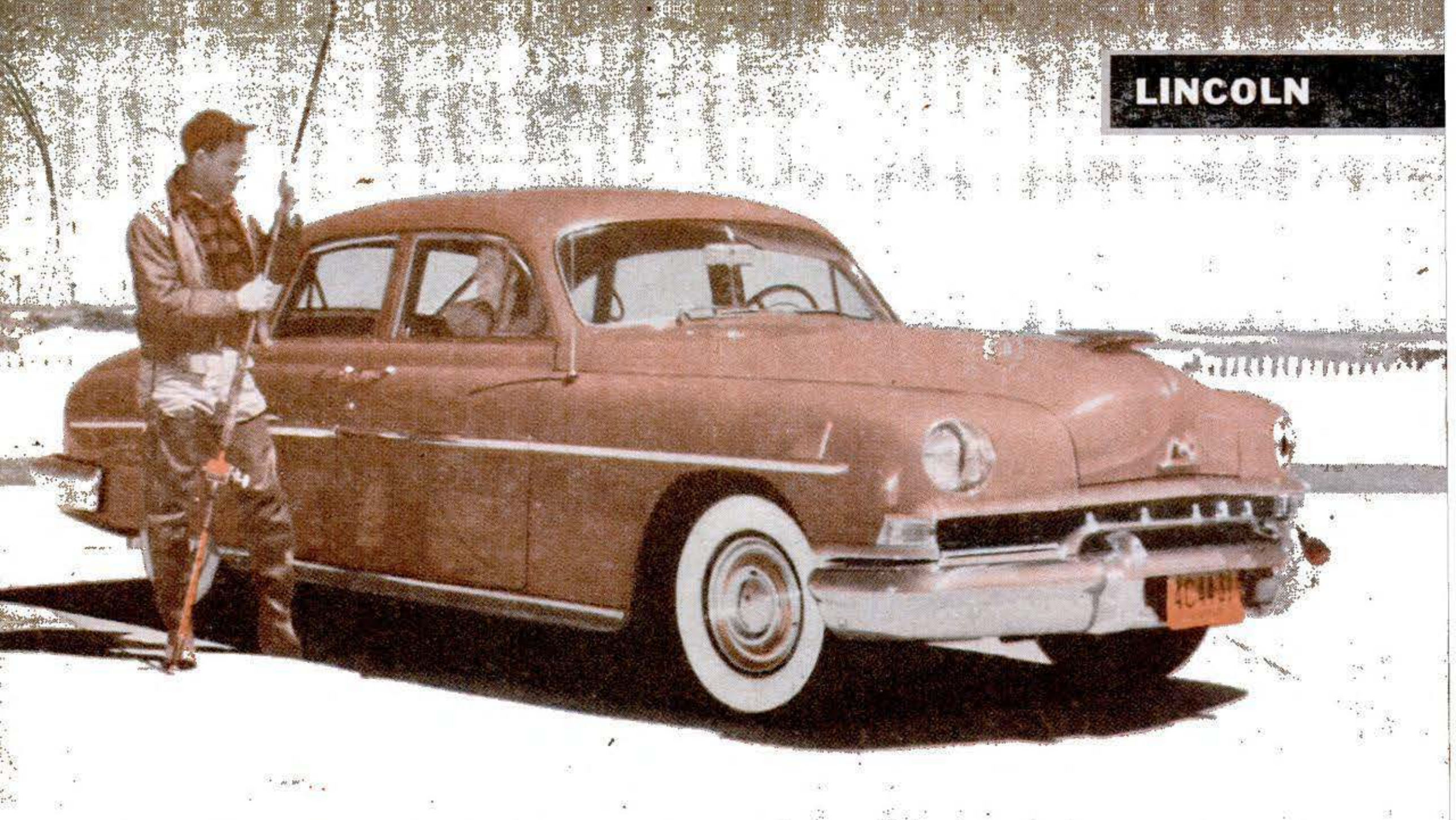


I found that the Lincoln had plenty of scat, despite a rear-axle ratio of only 3.31 to 1.

Slip Behind the Wheel

Lush, plush, and powerful, both Lincoln and Caddy sport the works in fancy

REPORT FROM THE

DRIVER'S SEAT . . .

By Wilbur Shaw
PS STAFF PHOTOS

IF YOU'VE never had the chance to drive one of America's luxury cars, climb in beside me now.

If you have driven a Lincoln or Cadillac, or own one, get ready for some fast conversation—because you can start an argument over these two automobiles anywhere, any time.

We put the new Chrysler through the hoops in the April issue of POPULAR SCIENCE, and the new Packard last September. The Chrysler and Packard models that sell in the upper money registers, and the Lincoln and Cadillac constitute the quartet of big, expensive jobs appealing to people who don't have to watch their bank balances.

The Lincoln is made by Ford and the Cadillac by General Motors—and there are no livelier rivals in the automobile business.

Each car has its virtues—and its faults. But who ever bought a yacht without getting bilge water?

The Lincoln and the Cadillac have a lot in common. Both are big. Both have lots of power, although less than the Chrysler. (When it comes to engines, the Chrysler actually is in a class by itself, as of this year.)

Lincoln has added a couple of horsepower to its 1951 jobs. Changes in styling in both Lincoln and Cadillac are minor. Fred Williams, Jr., Indianapolis dealer, supplied me this car.

The Cadillac has a new type of brake. With it, two tons of car stop remarkably easily.

# of These Luxury Cars

dressing and what really pays off—"superlative riding qualities."

You sit high in both cars. The visibility is good. It ought to be—with that much automobile to steer around, you have to know where you're going. Each has a lot of floss. Each, in the models I drove, was equipped with a Hydra-Matic drive.

Yet they're hard to compare. Just on one count alone—the engines—they are wholly different. While both are V-8s, the Lincoln's is an L-head with a relatively low compression ratio—7 to 1. Cadillac, with overhead valves, has a 7.5-to-1 ratio. It pioneered that in standard-sized cars, and the engine is designed to take a higher compression ratio if gasoline octane numbers go up at the filling station.

Cadillac has a "square" engine as to bore and stroke—both are about the same. By contrast, the Lincoln has a stroke quite long in relation to the bore.

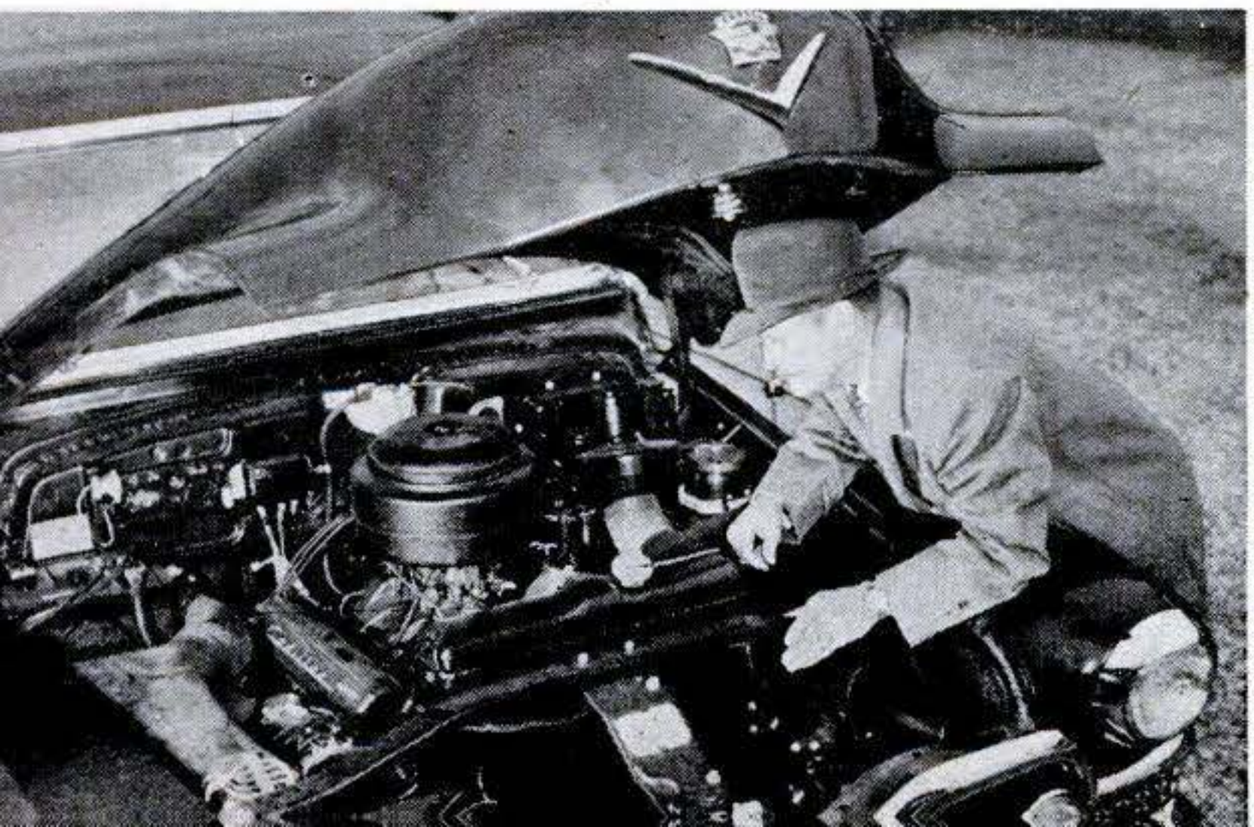
The Lincoln Cosmopolitan I drove was considerably heavier than the Cadillac "60" Special I tried out at the same time. The Lincoln's engine, with slightly less power, has to lug nearly five more pounds per horsepower than the Cadillac's.

So whatever I say about the two cars is not for purposes of direct comparison. They are merely two automobiles in the same general price class.

Here's the start of the playback of my remarks to the recording machine as I slid in behind the wheel of the Lincoln at the Indianapolis Motor Speedway:

This car is everything that it should be in

I keep wondering when car manufacturers are going to get the nerve to shorten their hoods. The dead-air space between the Cadillac's radiator and the bumperettes was exactly two feet.



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I rolled the Lincoln on the Speedway backstretch. Braking to a stop from an indicated 60 m.p.h. took 198 feet. This, of course, did not count the distance consumed by reaction time.

appointments . . . climbing into this is like . . . well, it's like sleeping under a down comforter . . .

It's few cars that have switches at the driver's left hand . . . to raise and lower every window automatically . . . and, bless my soul! even to move the seat back and forth . . . the hardware is all extra-fancy, and the seat fabrics are right from Fifth Avenue. The fabric is topped with leather at neck-height . . . it's the genuine thing, off the cow, too.

If you want the ultimate in Lincoln luxury, you buy a "Capri" model with a simulated leather top.

The windshield posts, I find, are a bit too thick . . . I mean, for good visibility . . . the entrance room could stand improvement . . . memo: measure that . . . you can see the road behind you in the rear-vision mirror, and that's something.

I began rolling the Lincoln on the track.

Acceleration about so-so . . . it took 19 seconds to get to 60 miles an hour . . . let's try that again . . . 17 seconds this time . . . it takes time to move weight . . . but it strikes me that third-gear acceleration is slow.

Memories of the Old Marmon

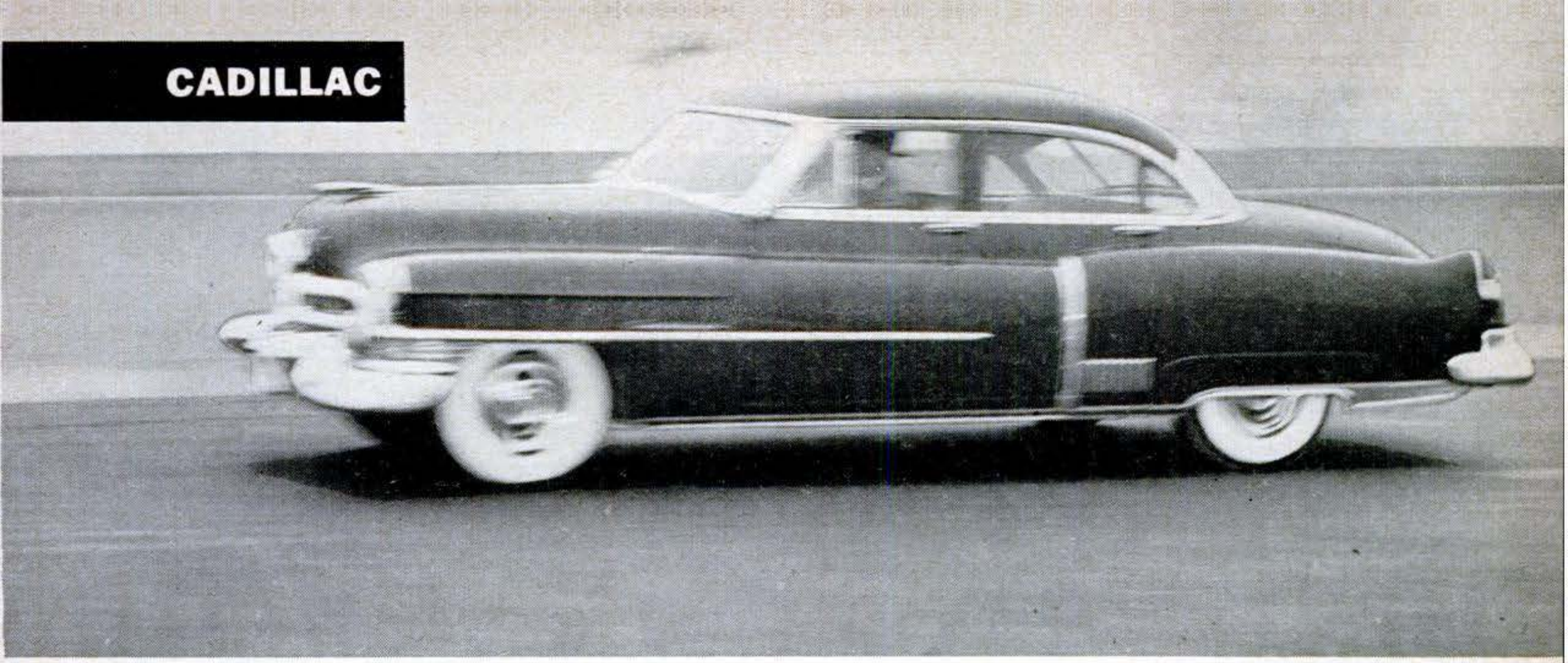
Now, for a change of pace, let's switch to my playback on the Cadillac.

There's less stoop and squat . . . you don't bend forward so much to slide into this seat . . . there's the same feeling of luxury in this car . . . reminds me of the old Marmon . . . somehow . . . and there was an automobile . . .

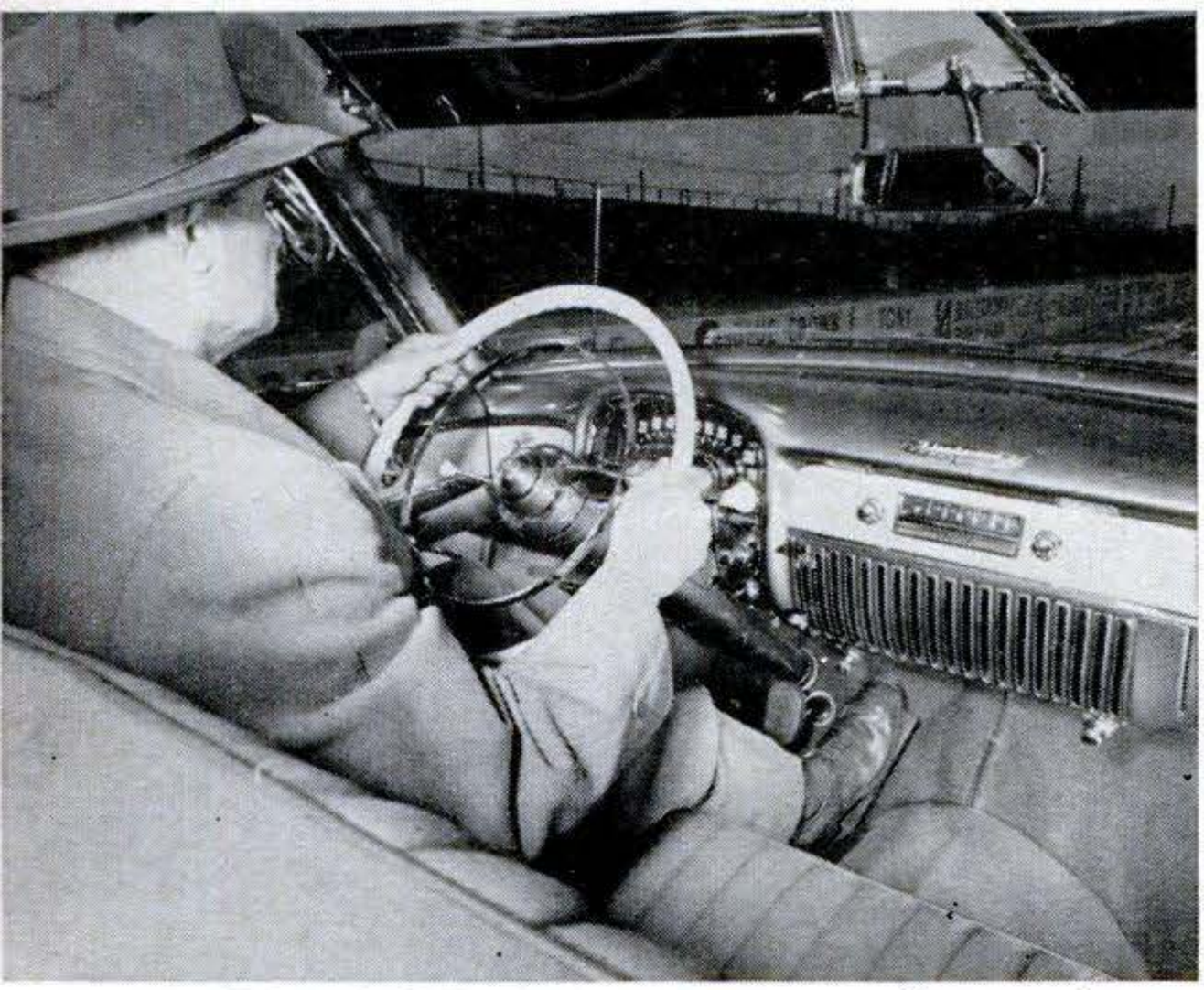
Like the Lincoln, this car contains those

The Lincoln's instrumentation is compact—in fact, too much so. You have to stretch down to reach the lighter, and the windshield-wiper control knob is right on top of the ash tray.

I am always curious about the entrance room in today's cars. The Lincoln's, for my money, is really inadequate—40½ inches high by 24¾ wide, measured from door to seat back.



Here you see the "60" model, loaned to me by Hoosier Cadillac, speeding along at the place on the track where I went over the wall in 1941. From 60 m.p.h., I stopped in 184 feet.



The Cadillac's instruments and controls are equally well grouped, but here I am trying to figure out the selector quadrant. In a turn, the steering wheel spokes hide the letters.

The Cadillac's entrance room was only a bit better—42 inches by 25¾. Incidentally, did you know that those "vents" where a Caddy's rear fenders start have no holes in them?

extra items that make you proud to park it in front of your house . . . you get two-toned fabrics, with leather trim . . . automatic lights to tell you when your oil pressure is low or your generator is discharging . . . a light to tell you when your hand brake is on . . .

And look! a blower to keep the rear window from fogging . . . radio speakers both front and rear . . . and controls to regulate their volume separately . . .

The view through the rear-vision mirror is fine . . . nothing wrong in that department . . . engine is quiet, like the Lincoln's . . . if there's the slightest bit of outside noise around, you have to touch the accelerator . . . or look at your instruments . . . to see whether she's turning over.

My acceleration to 60 in the Cadillac took 17 seconds.

Has Good Road Sense

Now here's the Lincoln again:

The car's road sense is good . . . she's solid on a curve . . . there's good steering-wheel resistance to a turn . . . she comes back from a hard 90-degree turn riding straight ahead, hands-off . . . the stability in a hard stop is excellent.

And the Cadillac:

For some reason I can't . . . I can't see the selector-lever positions on the quadrant . . . they've hidden 'em in some sort of a well on the steering column . . .

The instrument arrangement is good . . . and I'd like to remark right here that the heater and ventilator . . . the adjustments for regulating them are the simplest I've ever seen . . . you don't need a complete

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cockpit checkout to work them . . .

This, like the Lincoln, car also has good road sense.

Both the Lincoln and the Cadillac had superlatively good riding qualities. As compared with smaller cars, their rides were slightly stiff. That's not only acceptable, it's necessary, in heavy automobiles. There's less jounce and less obvious spring-damping after hitting the bump. I did find that the Cadillac transmitted less wheel bounce to the chassis on rough pavement.

The Lincoln again:

There's little wind noise . . . even with the vent cut down to small venturi size . . . but it's not quite as good as the Mercury's . . . There's some tire squeal in a flat turn at 40 miles an hour . . . and when you shift into reverse you have to pause in Low Range to prevent a gear-clash.

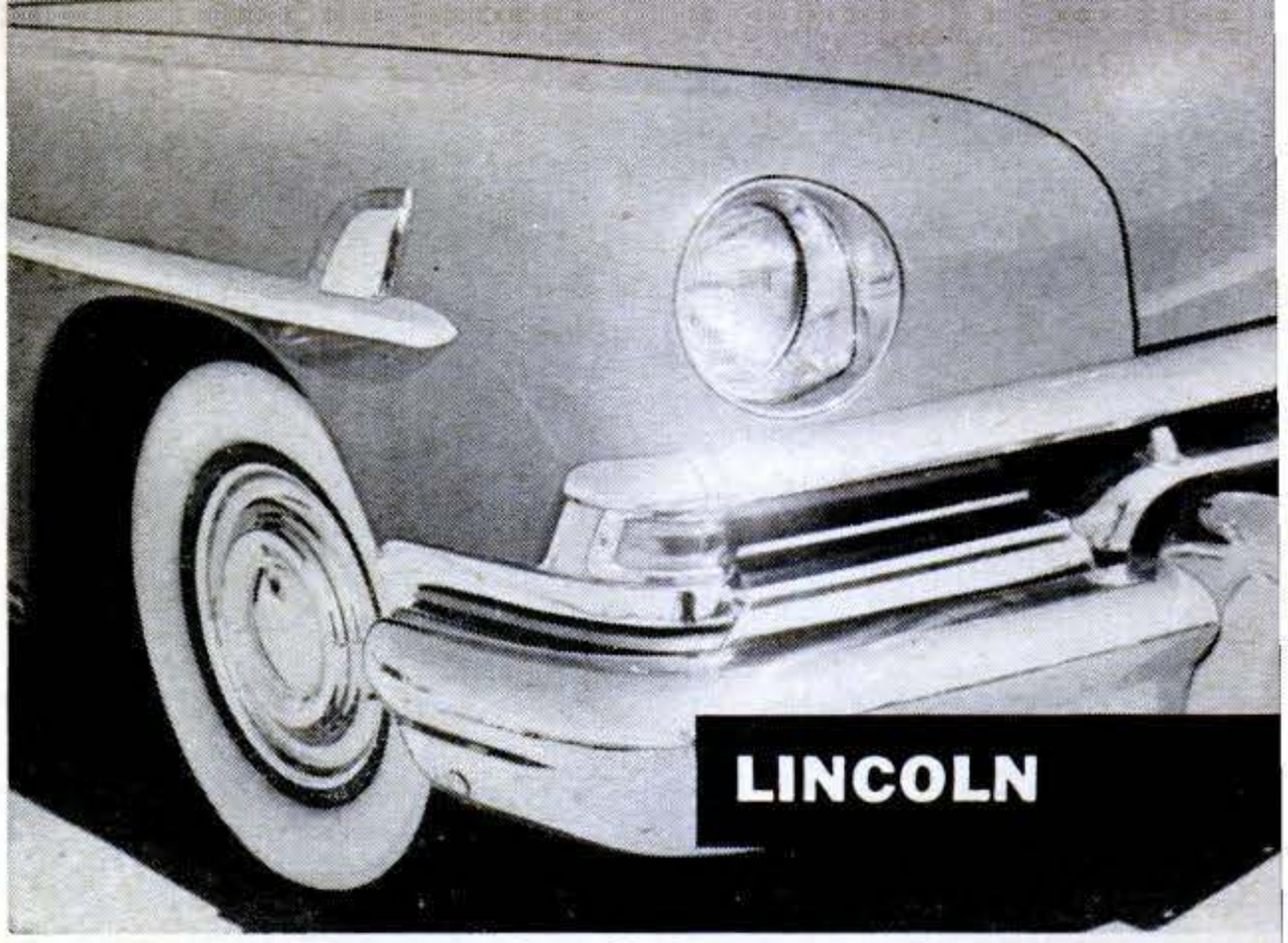
And on the Cadillac:

I don't get any wind noise at all until I hit 50 . . . this car could well be a standard of comparison for both noise and vibration . . . tire squeal is low . . .

Where's the Front Fender?

When it comes to hood styling, I'll take the Lincoln. The hood seemed easier to see over. In the Cadillac a man wouldn't know where the right front fender was unless he got out and looked at it.

Both cars had good downhill compression braking, the Lincoln a bit more than the Cadillac. I could get very little sway out of either on a hard turn. I didn't attempt to go into their indicated top speeds—both go too fast for Dad to trust Junior with them. Both had taken some of the jerk out of their



Here's a contrast in headlights. Lincoln retains its recessed lamps. The car's one-piece front and rear fenders, extending even into the turtleback, would make repairs expensive.

Lincoln has made a smart move in reducing the width and area of the useless shelf above the instrument panel. This puts the driver closer to the windshield for safer motoring.

FACTS ON THE '51 LINCOLN

Make and model: Lincoln Cosmopolitan four-door sedan.

Engine: V-8 L-head; 154 hp. at 3,600 r.p.m.; car weight per hp., 29.8 lb.; bore and stroke, 3½" by 4⅜"; compression ratio, 7:1; piston displacement, 336.7 cu. in.

Engine-piston travel: (in feet per car mile)—1,690.

Crankshaft bearing surface: 46.5 sq. in.

Torque: 275 lb.-ft. at 1,800 r.p.m.

Transmission: Hydra-Matic.

Rear-axle ratio: 3.31:1.

Steering ratio: 22.3:1.

Radius of turning circle: 22.4'.

Effective brake-lining area: 196.5 sq. in.

Springs: front, coil; rear, semi-elliptic.

Weight and outside dimensions: 4,590 lb.; height (no load), 64.1"; over-all length with bumpers and guards, 222.5"; width, 78.2"; wheelbase, 125"; front overhang, 40.7"; rear, 56.4"; tread, front, 58½"; rear, 60".

Inside dimensions: Seat-cushion width, front, 58.8"; rear, 61.5"; leg room, front, 40"; rear, 40.3"; headroom, front, 36"; rear, 36"; seat height, front, 12"; rear, 12"; vertical distance, steering wheel to seat cushion, with seat in mid-position, 5.2"; front-seat adjustment, horizontal, 4"; vertical, .06".

Tire size: 8.20 by 15.

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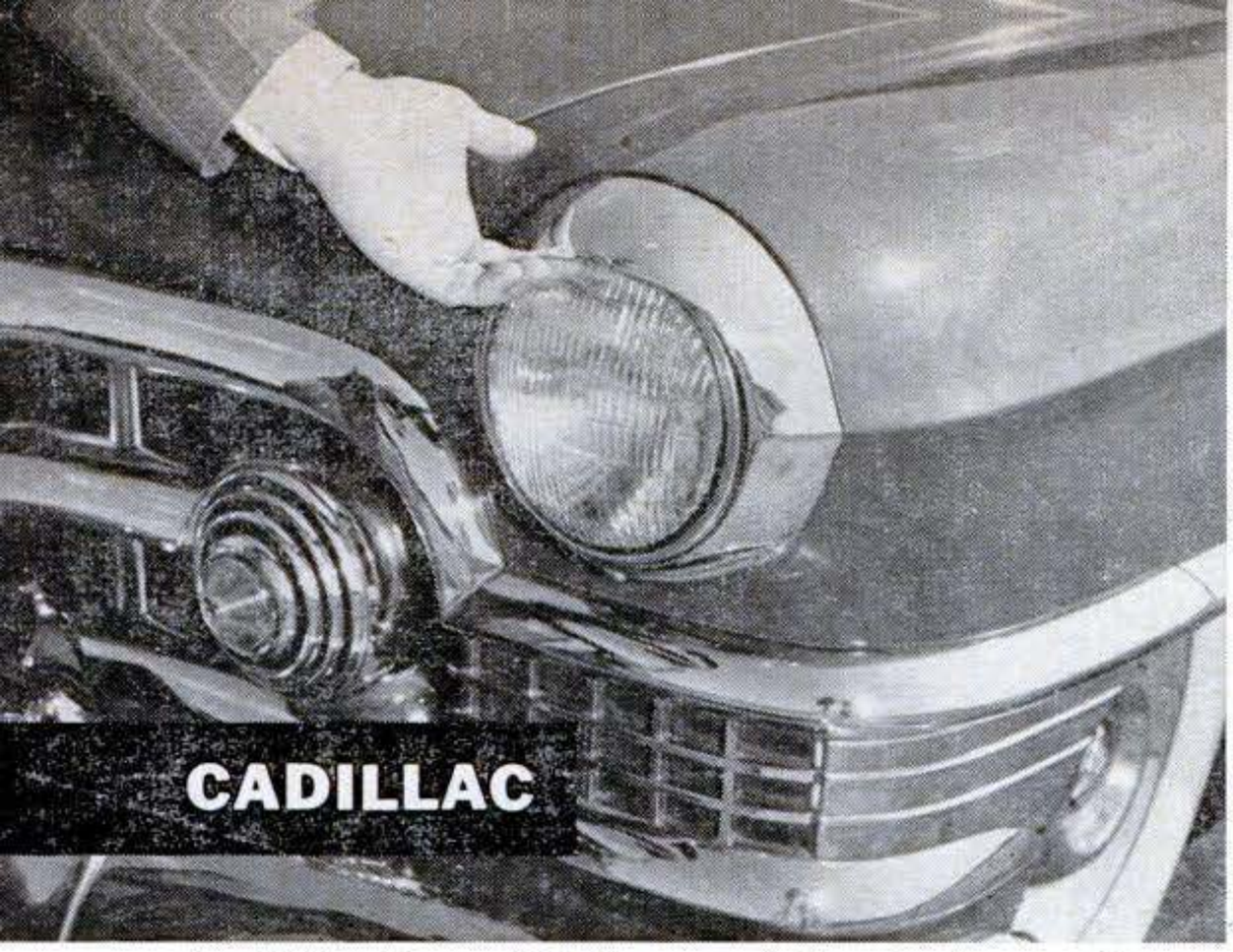
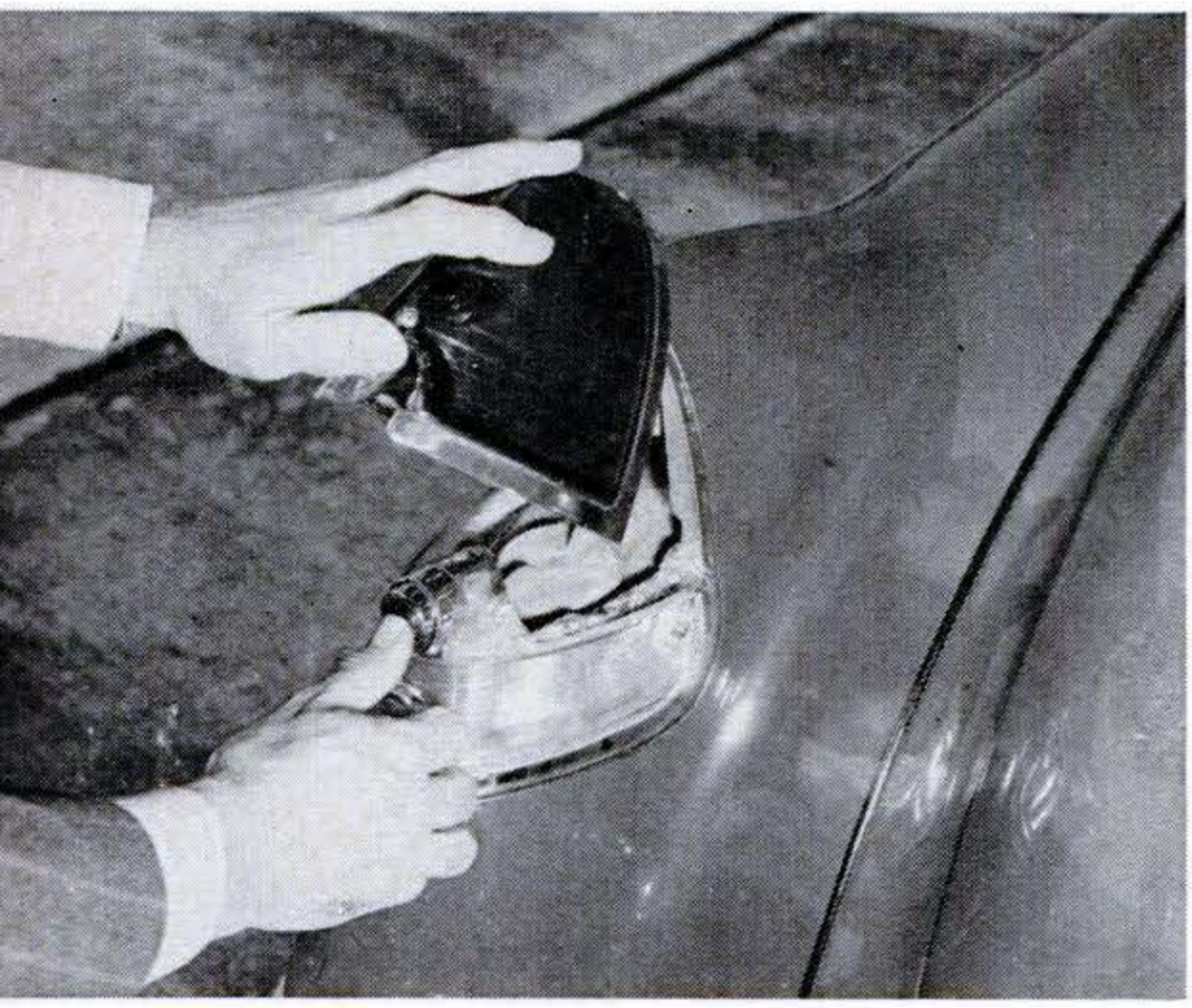


Cadillac has added an eyelid to its lamps, largely for ornamental reasons. Neither car, I was happy to discover, had any "creep" at a standstill, once its engine was warm.



And Cadillac finds a way to avoid breaking its distinctive sweep of rear-fender area with a lid for the gas-tank filler tube. It's in the stoplight fin. A button releases the lens.

downshifts, inevitable when decelerating with Hydra-Matic.

I wonder why Lincoln clung to automatic mechanical transmission—the product of a competitor—in the presence of a brilliantly engineered torque converter now available on the Ford and Mercury, two other cars from the same company stable (PS, Dec. '50, p. 94).

Fuel-wise, neither car when equipped with Hydra-Matic drive is recommended for the man who has to buy his gas five gallons a stanza. With a manual shift, practically impossible to get on a Cadillac now, both cars do a lot better. Lincoln won the Mobilgas Grand Canyon Economy Run (PS, June '51, p. 168) this year.

It isn't a matter of choice between a Cadillac and a Lincoln, or a Chrysler or a Packard. It's a matter of custom in the individual family. Dad owned a Cadillac, so the son keeps up the tradition.

Both the Lincoln and the Cadillac are luxurious cars. Personally, if someone came around and offered me either of them for one Wheaties box top and a really good trade-in, he'd go away without an automobile. **END**

This Month's Shaw-ism

Many a slick car has come to grief on a slick pavement.

Kilbourn Shaw

FACTS ON THE '51 CADILLAC

Make and model: Cadillac "60" Special four-door sedan.

Engine: V-8 overhead valve; 160 hp. at 3,800 r.p.m.; car weight per hp., 25.2 lb.; bore and stroke, 3 13/16" by 3⅝"; compression ratio, 7.5:1; piston displacement, 331 cu. in.

Engine-piston travel: (in feet per car mile)—1,453.

Crankshaft bearing surface: 47.6 sq. in.

Torque: 312 lb.-ft. at 1,800 r.p.m.

Transmission: Hydra-Matic.

Rear-axle ratio: 3.36:1.

Steering ratio: 21.3:1.

Radius of turning circle: 23'.

Effective brake-lining area: 224.5 sq. in.

Springs: front, coil; rear, semi-elliptic.

Weight and outside dimensions: 4,040 lb.; height (normal load), 62 11/16"; overall length with bumpers and guards, 224.5"; width, 80⅛"; wheelbase, 130"; front overhang, 36⅜"; rear, 58⅛"; tread, front, 59"; rear, 63".

Inside dimensions: Seat-cushion width, front, 63½"; rear, 64½"; leg room, front, 44⅜"; rear, 42"; headroom, front, 35½"; rear, 36"; seat height, front, 14 13/16"; rear, 12⅛"; vertical distance, steering wheel to seat cushion, with seat in full rear position, 5⅜"; front-seat adjustment, horizontal, 4"; vertical, ¾".

Tire size: 8.00 by 15.

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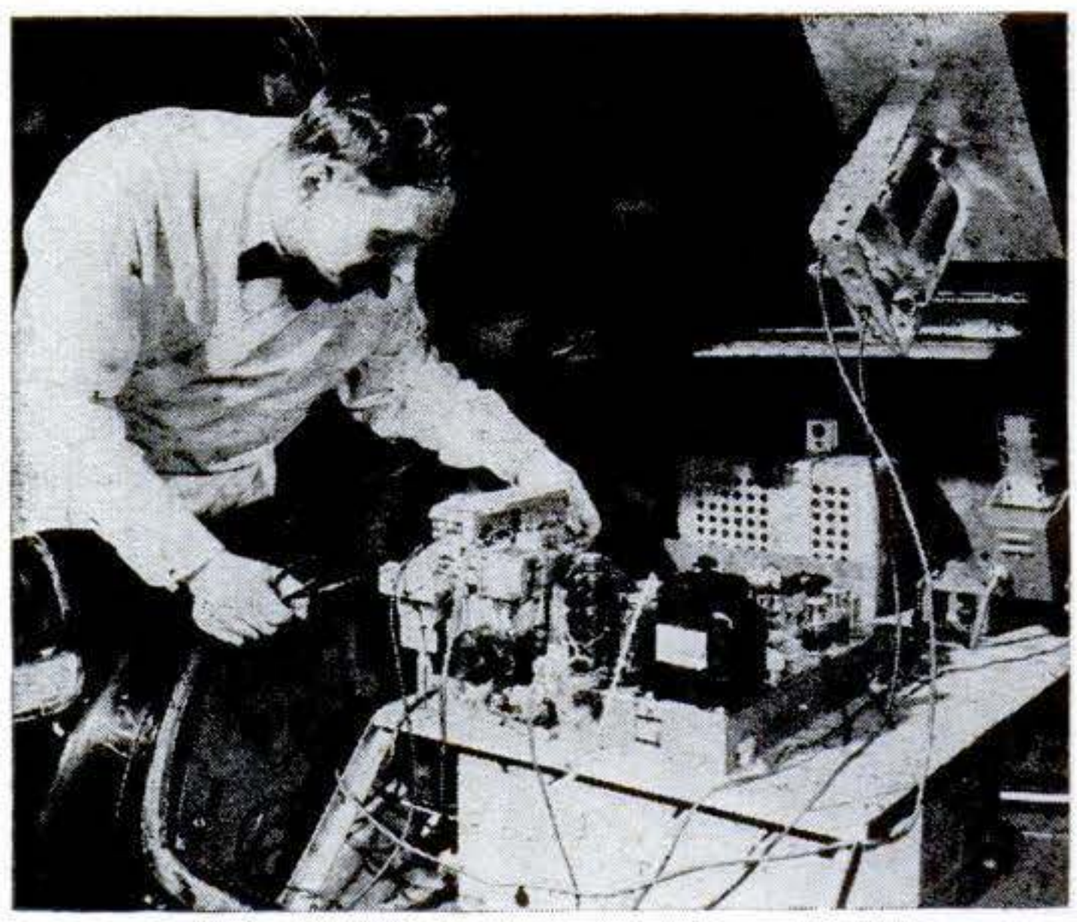
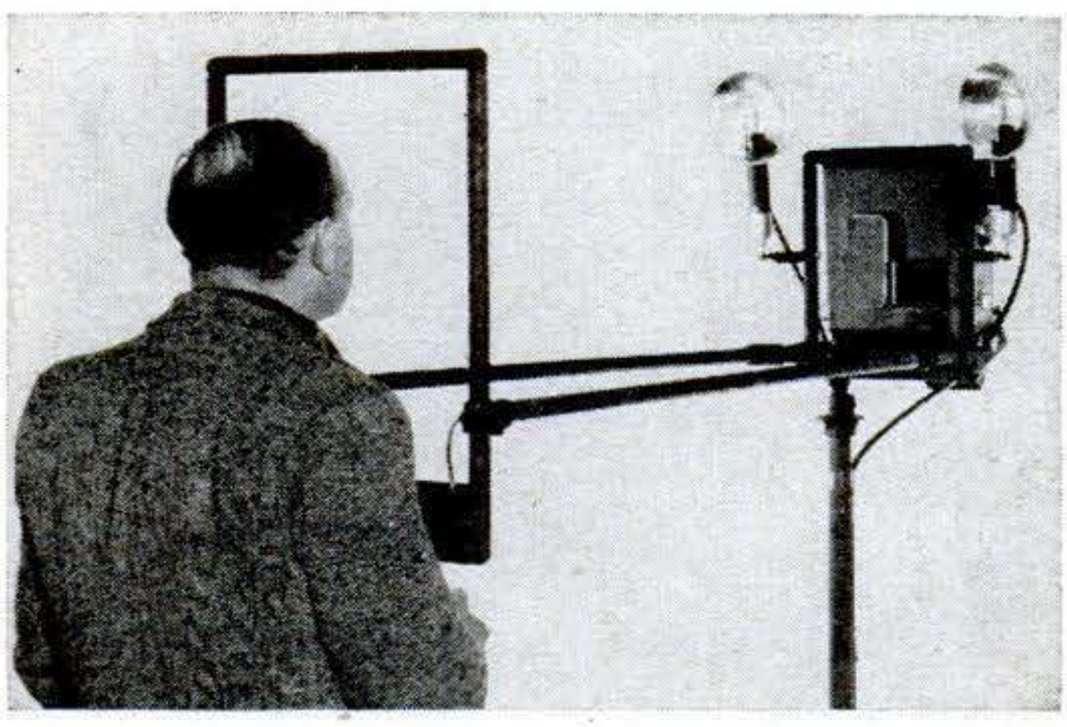
Back-Seat Passengers View Video

IT HAD to come sooner or later—now they're putting television receivers in automobiles.

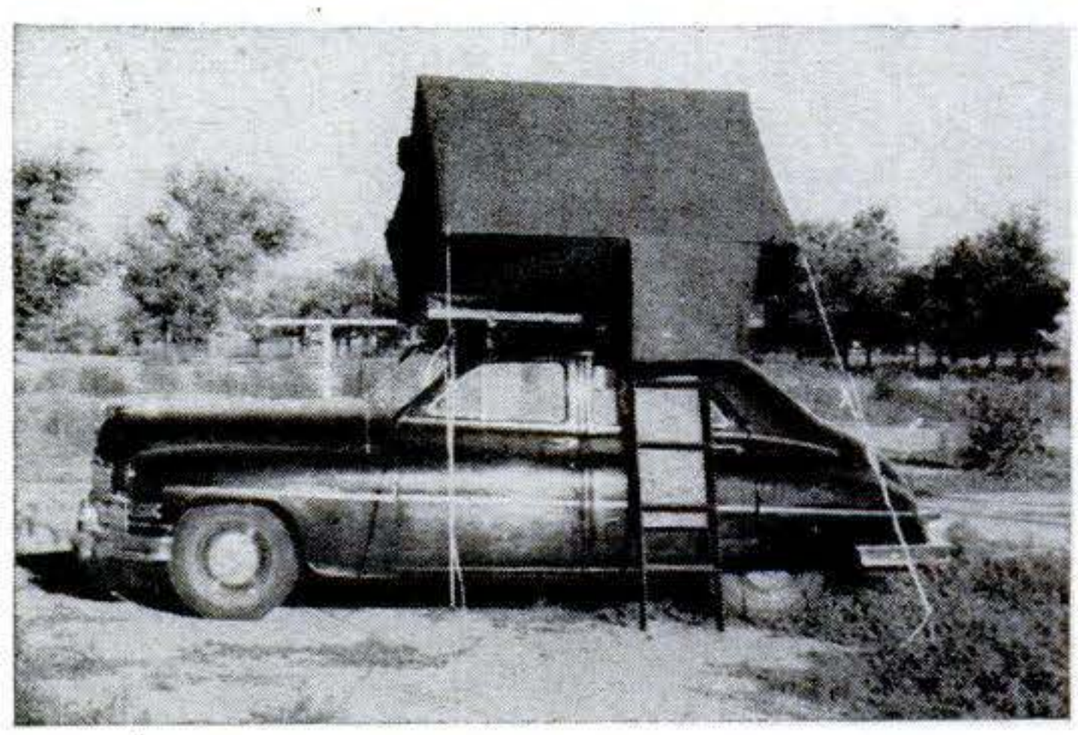
William B. MacDonald, Jr., Chicago executive, wanted to give his rear-seat passengers TV entertainment. So he mounted an antenna on his trunk lid and put the TV chassis in the trunk proper. He built the viewer into the back of the front seat. An electrically driven rotor turns the antenna for directional beaming. A remote-control panel for picture and sound is mounted in one of the arm rests. The set, a Zenith, has a 12½-inch screen.





British Camera Snaps 'Em Quick

A BRITISH camera that does everything but snap the shutter can make self-portraits on a mass-production basis with exposures of less than 1/5,000th of a second. Pressing a button automatically releases the shutter, sets off two electronic flash lamps, and advances the film for the next exposure. A motor, gears, and automatic relays do the job. One roll of film produces 450 negatives, and photos can be taken at the rate of 1,200 an hour. Made by Charles Powis & Co., the camera, designed for identification photos, also can be used for baby portraiture and manuscript copying.



Camp Out on Top of Your Car

Now you can go tenting on top of your car, free of snakes, ants, and rain. Secured to the car top by suction cups, this tent has a wooden floor and holds a full-size double-bed mattress. The tent walls extend beyond the sides of the car and are anchored by guy ropes. There is a 28-inch space on each side of the bed to store the pull-up ladder and clothes. Ventilation is furnished by three screened windows that are protected from the rain. When you're ready to move on to a new camping spot, you just fold the tent and lace it down with a waterproof cover. Castle Tent Co., Minneapolis.

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$2 Million-a-Mile Road Will Cross New Jersey

This speedway with built-in safety curves may be America's finest highway.

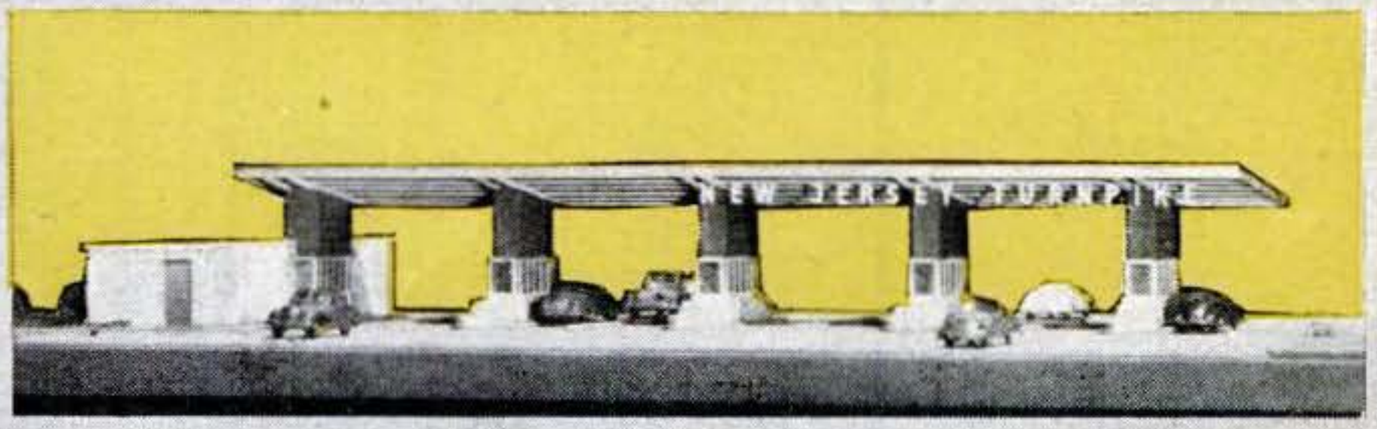
By George H. Waltz, Jr.

NEW YORK CITY, Jimmy Walker once quipped, will be a great place when they finish building it.

Driving into New York will be a great experience, too — when the superhighways from the South, West, and North are finished.

A central link in this great system—which will extend from Wilmington, Delaware, and Toledo, Ohio, to Portland, Maine—is being built now. This 118-mile link, the New Jersey Turnpike, is costing more than $2,000,000 a mile, and the men who know touring best say that it will be the finest high-speed road in America.

On it, you'll be able to drive from Wil-



Toll houses, like scale model at right, will be located at each of 17 interchanges along the route where motorists can enter or leave road. Below, steelwork is going into place to bridge marshland near Newark, N. J.

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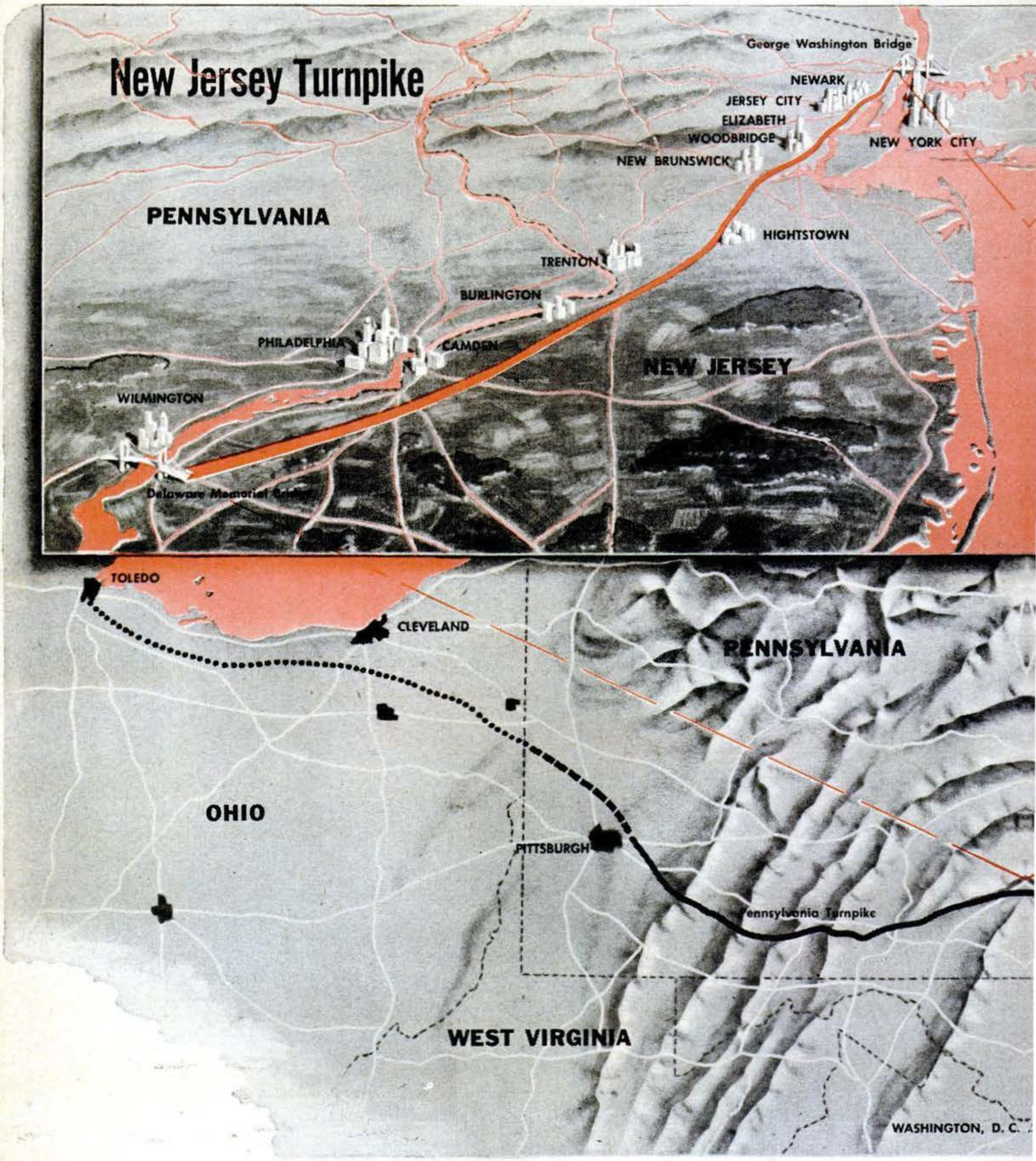
mington, Delaware, to New York—one of the busiest routes in the world—in under two hours, less than half the time it now takes. To do this, the superhighway will provide a direct link between two of America's great bridges, the George Washington over the Hudson and the new Memorial Bridge over the Delaware. From one end to the other you won't cross an intersection, stop for a light, or turn off onto another road.

This speedway, moreover, has been designed to be safer than any comparable road. On the Pennsylvania Turnpike last year, 59 persons were killed, 624 were injured, and property damage soared to more than $1,000,000. Many of these accidents resulted from "velocititus"—the insidious hypnotic malady that often dulls the senses



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of a driver wheeling monotonously along a splendid road.

In New Jersey, the landscaping will be so varied that it will help keep drivers alert, and the road will be so constructed that there will be no long, true straightaways. You'll have to exert slight pressure on the steering wheel all of the time, because the road will curve slightly all of the time, first one way and then the other.

Center Island to Divide Traffic

Another safety feature will be the wide center strips between opposing lanes of traffic. They will be raised islands, from 18 to 94 feet wide, carefully landscaped to eliminate the glare from oncoming headlights.

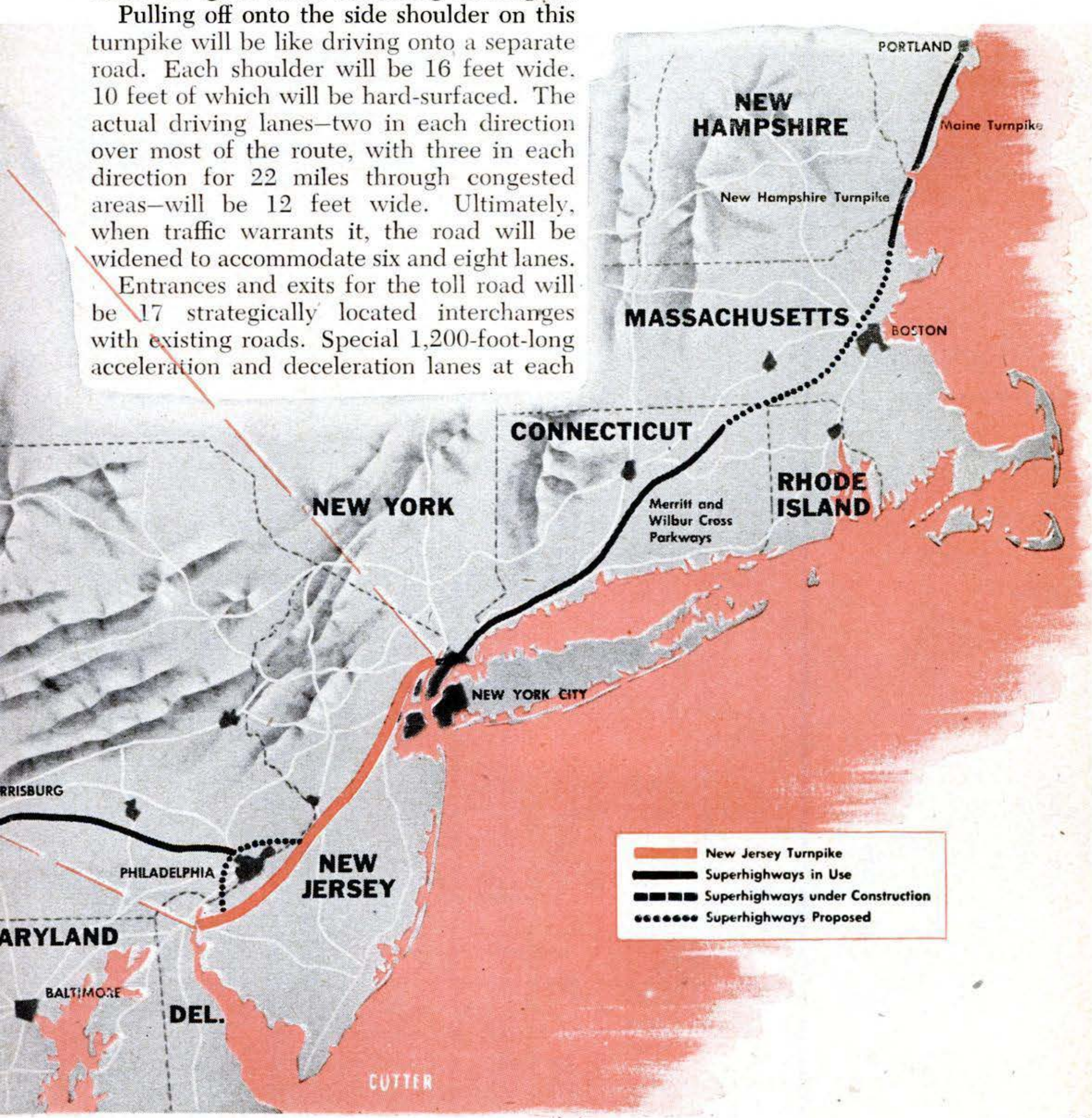
Pulling off onto the side shoulder on this turnpike will be like driving onto a separate road. Each shoulder will be 16 feet wide. 10 feet of which will be hard-surfaced. The actual driving lanes—two in each direction over most of the route, with three in each direction for 22 miles through congested areas—will be 12 feet wide. Ultimately, when traffic warrants it, the road will be widened to accommodate six and eight lanes.

Entrances and exits for the toll road will be 17 strategically located interchanges with existing roads. Special 1,200-foot-long acceleration and deceleration lanes at each interchange will smooth the merging traffic and help prevent accidents.

Although no speed limit has been set, the road has been designed for 75 m.p.h.

There will be no hills, no traffic lights, no crossings, no left turns, and no uncontrolled merging to slow traffic.

Within two years, another new road will link the New Jersey Turnpike with the Pennsylvania Turnpike to form a continuous toll-road system from Ohio to New York. When another new pike, across Ohio, is completed, Toledo, Cleveland, Pittsburgh, Harrisburg, Philadelphia, Camden, Trenton, New Brunswick, Newark, and New



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Obstacles were underpassed or overpassed. Though it doesn't look it, Pike will dip under

Big problem was to avoid interrupting utility services during construction of the road. Here, workmen are carefully moving coaxial phone cable linking New York and Philadelphia.

York will be brought many hours closer together.

In the North, the Maine and New Hampshire Turnpikes are already open to the public. When the proposed Massachusetts Turnpike is completed some years hence, it will connect with the Wilbur Cross and Merritt Parkways in Connecticut and the Westchester Parkway system in New York.

By 1955, it should be possible to drive all the way from Portland, Me., to Toledo, Ohio—almost one-quarter of the way across the country—without ever leaving a high-speed superhighway!

How It Is Built

Countless construction headaches confronted the engineers in New Jersey. They had to build much of the road on mucky, shifting marshland. Existing roads and superhighways such as the Pulaski Skyway had to be overpassed or underpassed. Sprawling railroad yards had to be moved, portions of towns torn down, and parts of

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Pulaski Skyway, above, with 15 ft. to spare.

several big manufacturing plants relocated.

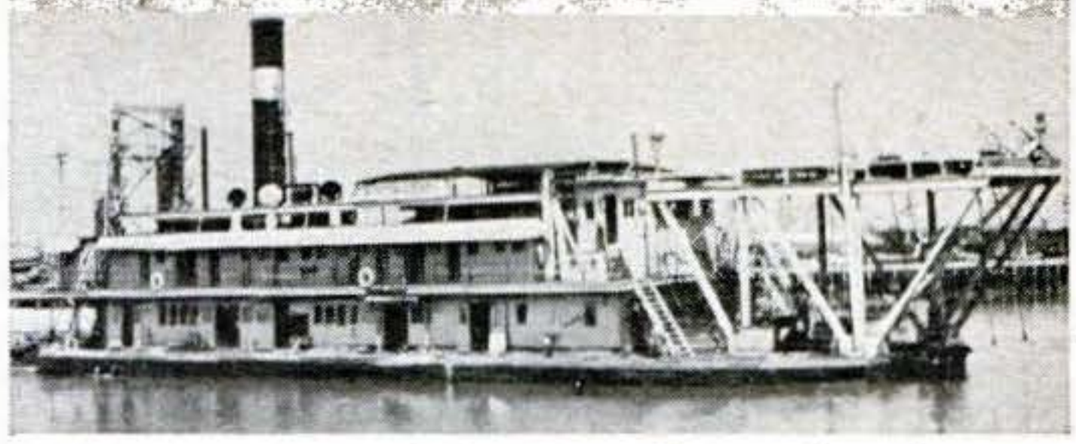
In Elizabeth, N. J., 455 buildings were demolished to cut a swath for the roadway, and at Linden, five giant gasoline storage tanks were moved and oil pipelines, power and telephone lines, and water lines were re-routed to permit the highway to cut through Standard Oil's big refinery.

To make sure that no hill will rise more than three feet in every hundred—as grades go, that's practically level—more than 51,000,000 cubic yards of dirt had to be moved. That's enough dirt to fill more than a million railroad hopper cars.

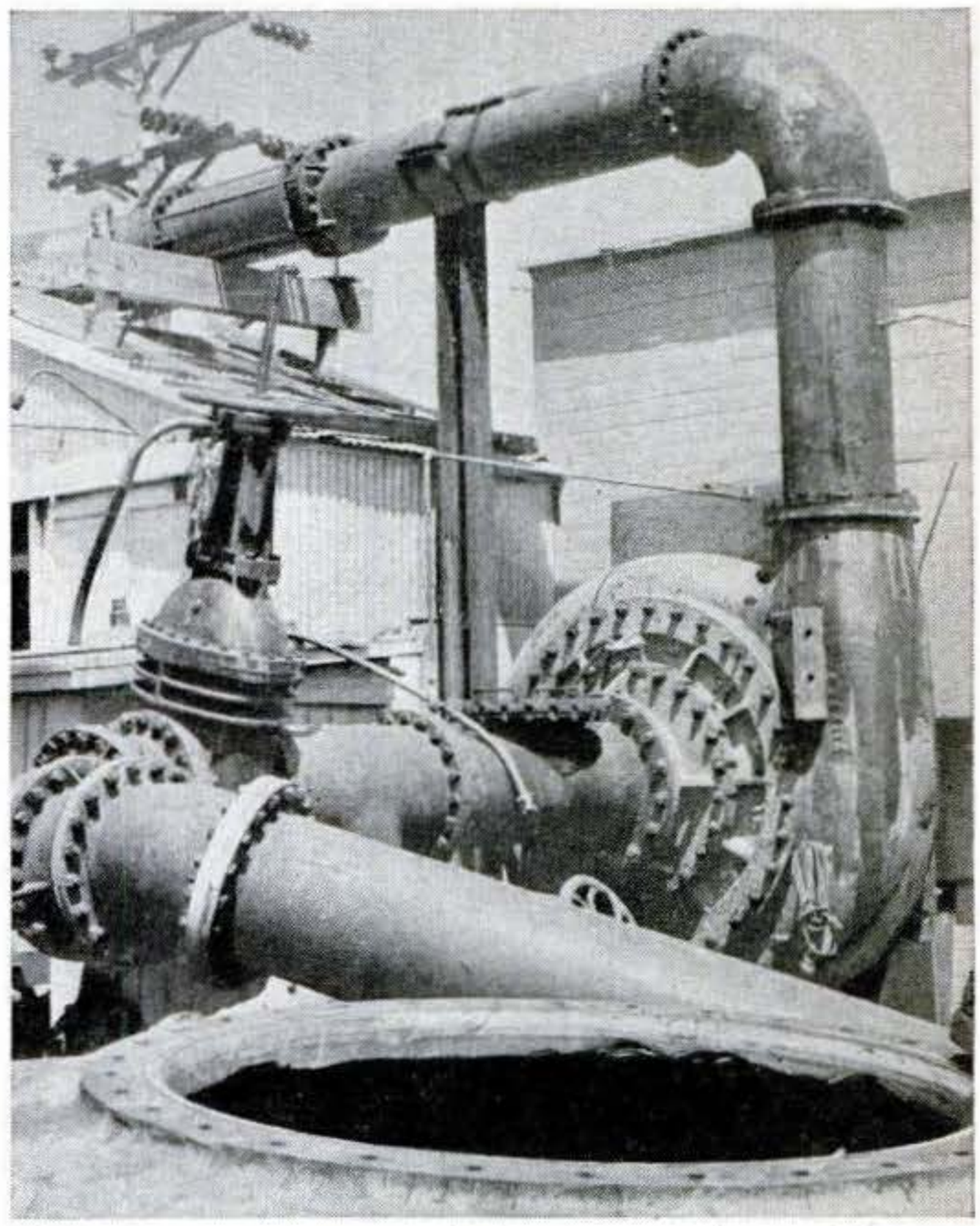
Cuts as deep as 55 feet and fills as high as 65 feet were needed to iron out the hills and valleys. More than $45,000,000 worth of earth-moving equipment was used at one time, and a two-way radio network was needed to direct the earth-hauling trucks.

About 114 miles of the finished road will be on a raised embankment. The other four miles will consist of 263 culverts, bridges, and overpasses. While most of the embank-

MOVING A SAND MOUNTAIN



1 Dredge in catch basin sucks sand and water up and feeds it to pipe leading to road site. Sand is hauled from ocean and dumped in basin.



2 Booster pumps help to send sand-water mixture on its way. Because they are ground away by sand, pump impellers last only a week.

3 This mountain of sand—part of embankment for the road over marshland—rises 60 ft. Sand pipe can be seen in foreground.

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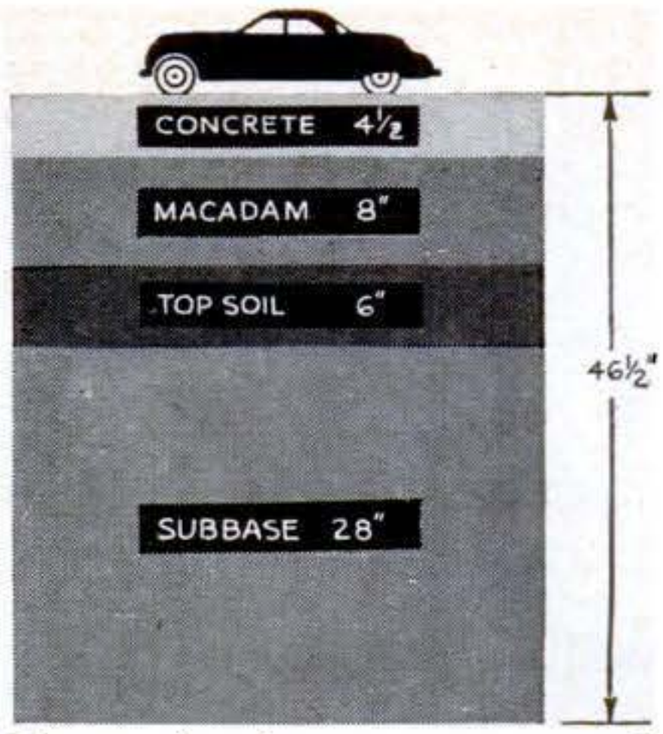

Compacting the subbase for the road is an important operation. Much of this work is being done by wide-wheeled tractors loaded with concrete and towing weighted "wobble-wheel" trailers. The wobbling wheels serve to spread the surface dirt and pack it down. Roadbed (drawing at right above) will have 28-in. subbase. Surface will be asphaltic concrete.

ment will be dirt, well compacted to form a solid roadbed, about 10 miles of the road will bridge marshland on a long ribbon of sand—sand that until recently was a part of the ocean bed (PS, Jan. '51, p. 106).

Dredged up and ferried to a catch basin at Port Newark, the sand was then pumped under pressure through miles of 20-inch pipe. Mountains of this white beach sand were pumped into embankments as high as 60 feet and broad enough at the top to accommodate the 250-foot-wide roadbed.

Sand Fill Speeds Settling

By using sand, rather than earth, for the marshland embankments and by employing sand drains (vertical columns of sand sunk down into the ooze under the embankment), the settling time for the fill was cut from years to months. The weight of the fill literally pushed the marsh water into the vertical sand columns and allowed it to drain off.

The actual roadbed is being added now. It was designed to carry the heaviest loads rolling along the public highways with a substantial margin of safety. It will be a 34-inch layer of rolled and well compacted subgrade earth, plus an 8-inch layer of macadam (the black stuff that forms the top surface of many roads), topped with a 4½-inch layer of asphaltic concrete.

Asphaltic concrete is made by mixing fine and coarse aggregate with asphalt rather than Portland cement. Mixed hot and poured, it is then rolled into a smooth road surface that remains plastic and flexible. It has high nonskid qualities and will not chip or crack under the pounding of heavy axle loads. Designed to take axle loadings as high as 36,000 pounds, the Pike's road surface will more than double the recommendations of the American Association of State Highway Officials. Its load-carrying capacity will be surpassed only by that of bomber runways on a few airfields. END

The latest in road-building equipment is being used. The grader, above, has a telescoping arm that can reach out 24 ft. to scoop up earth. Controlled hydraulically by operator in the cab, boom can be extended, retracted, lowered, raised, tilted, or rotated 360 deg.

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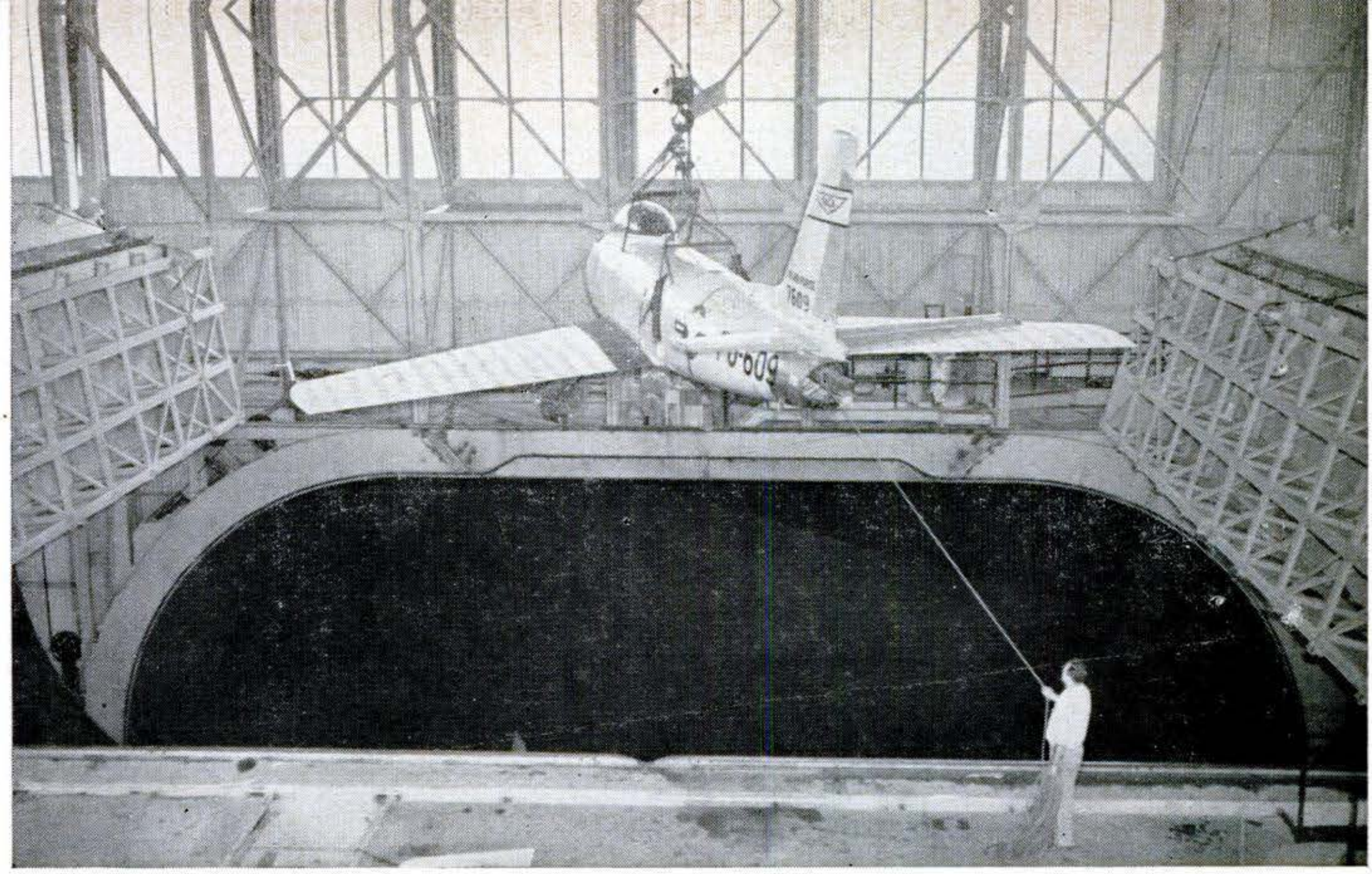
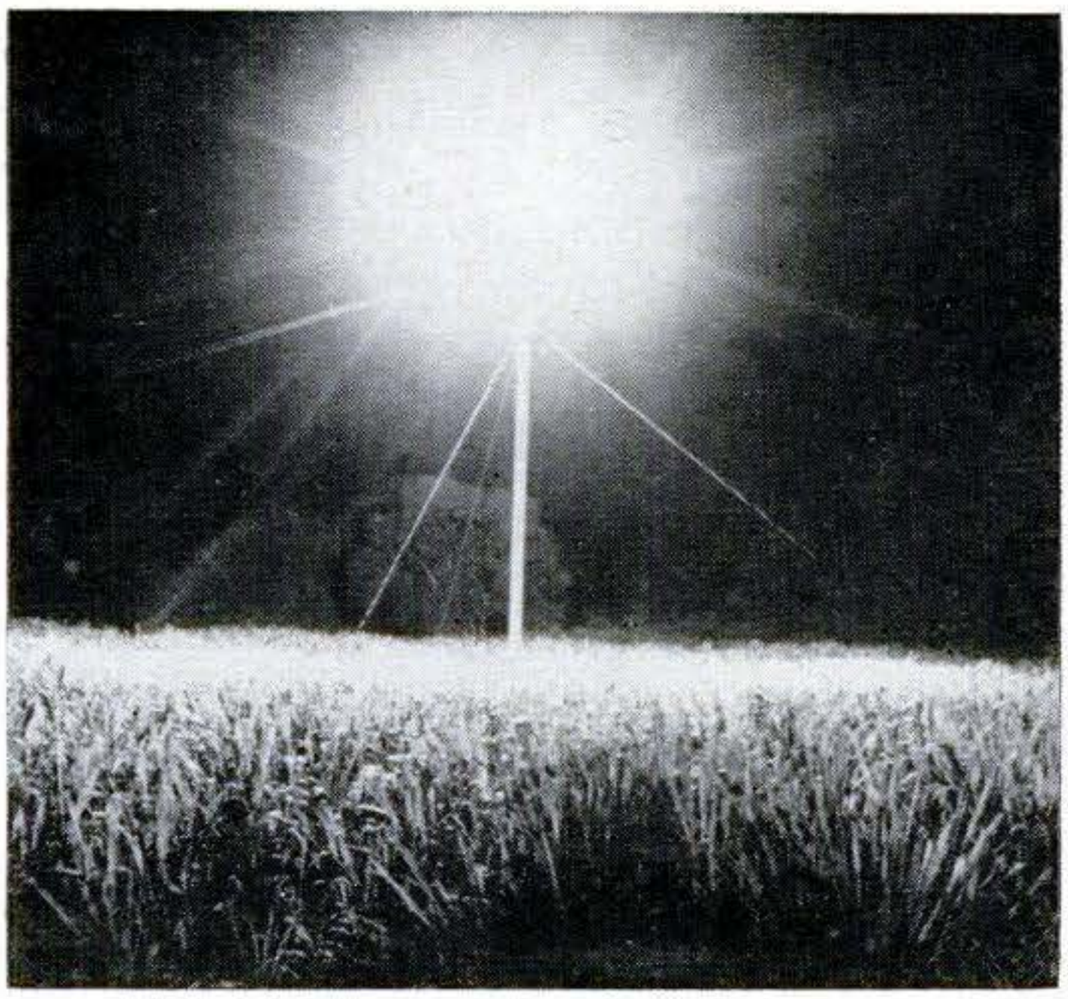


Wind Tunnel Swallows Jet Fighter

A NORTH AMERICAN Sabre, world's speed champion, is shown above being lowered into the world's largest wind tunnel at NACA's Ames Laboratory in California. The tunnel test will show how air flows over its sweptback wings at landing speeds. Massive, 60-ton doors swing down to form an air-tight seal when the big F-86 Air Force jet has settled on wing- and tail-supporting struts. These are connected to scales that weigh aerodynamic performance—lift, drag, and thrust—when winds up to 250 m.p.h. blow through the tunnel.



Lights "Wake Up" Sugar Cane

IF SUGAR cane gets too long a night's "sleep," the plants may produce tassels—and less sugar. That's why the Hawaiian Sugar Planters' Association is experimenting with varying periods of brilliant night lighting. One test showed that the sugar yield increased more than a ton an acre. Lights on poles, powerful searchlights, and even high-intensity photoflash bulbs are being used.

Clock Face Doubles as Lamp

THE photo above was taken using only light from the clock dial, an "electroluminescent" sheet of glass. This new lighting method uses a sheet of electrically conducting glass, sprayed with a thin layer of phosphor, and backed with a film of metal foil. The phosphor glows whenever alternating current is applied to it. The method, developed by Sylvania, might be used to light rooms.

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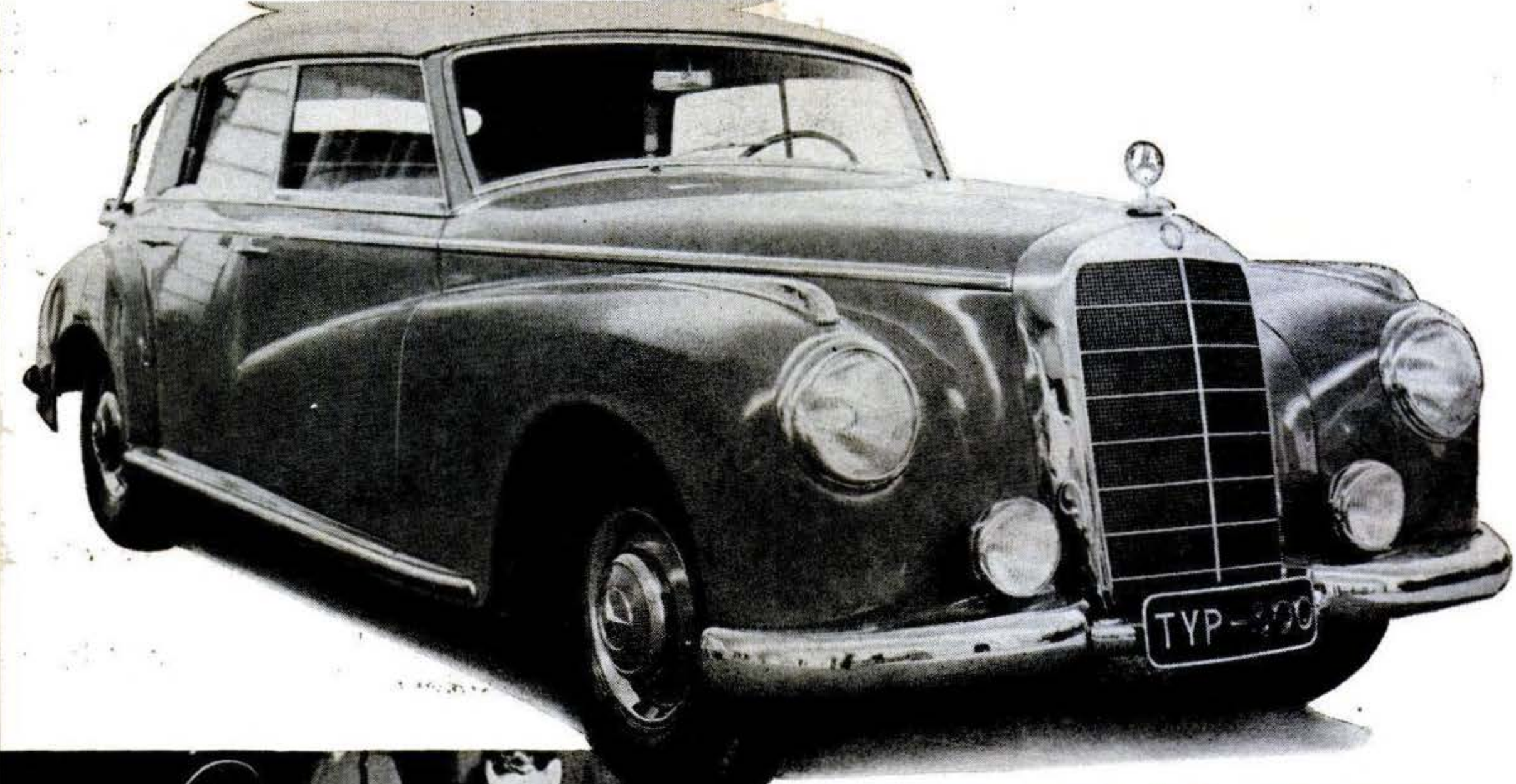
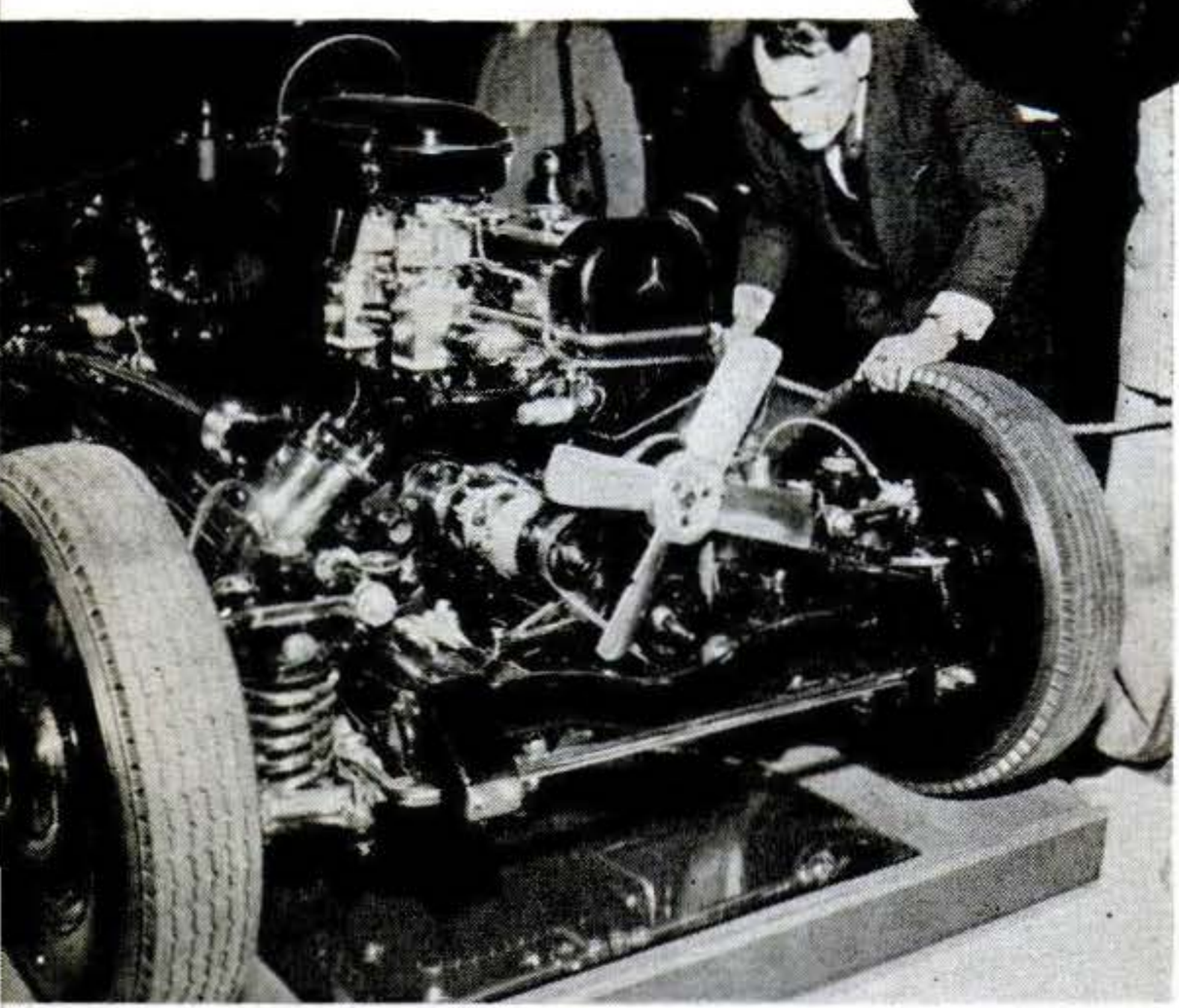


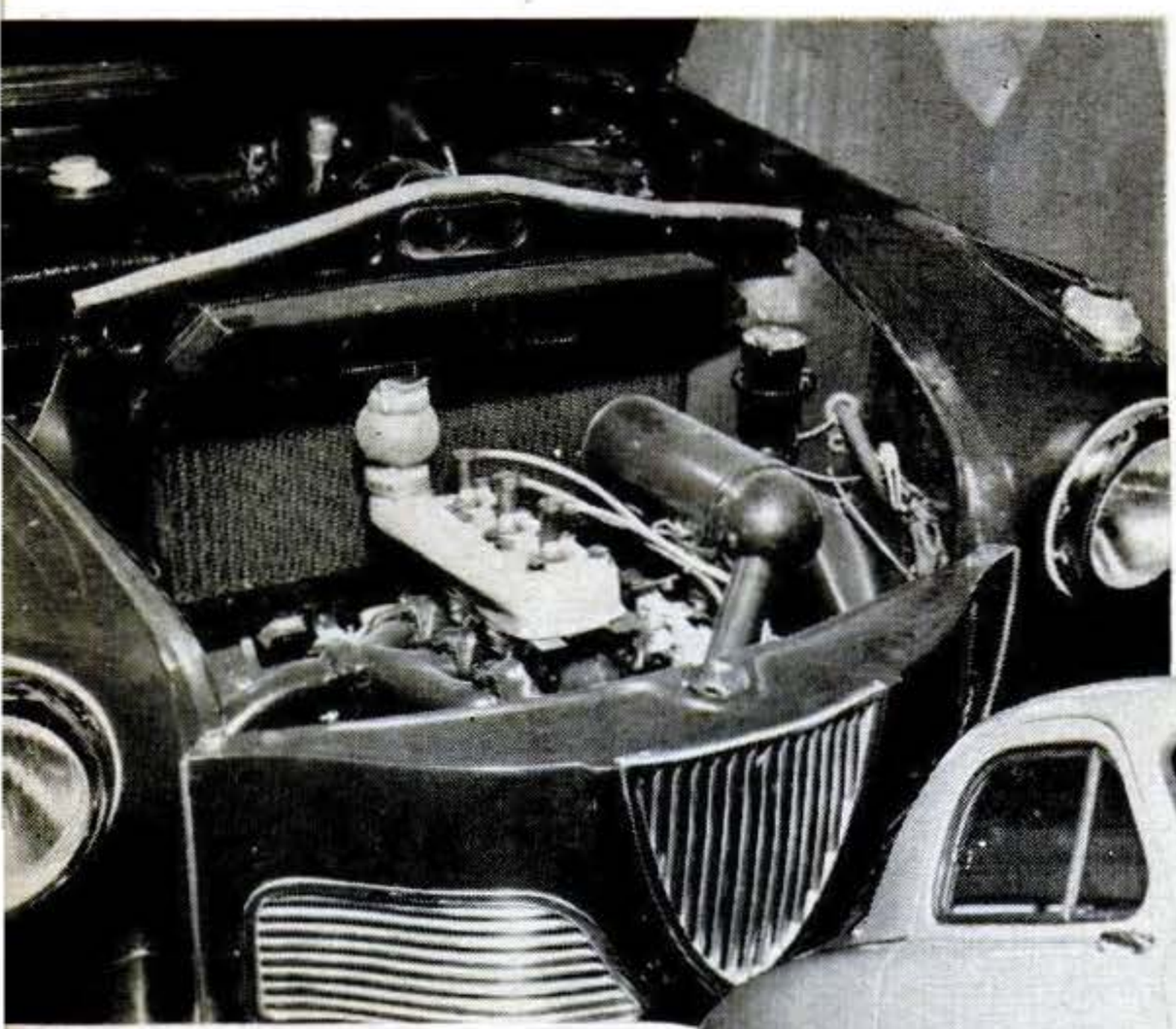


Mercedes cabriolet, born of West Germany's revived automobile industry, is a 1951 version of its famous predecessors. Its 6-cylinder engine, left, has 183-cu. in. displacement, produces 115 hp. Top speed is 96 m.p.h. Car costs 22,500 Marks, or about $5,350.

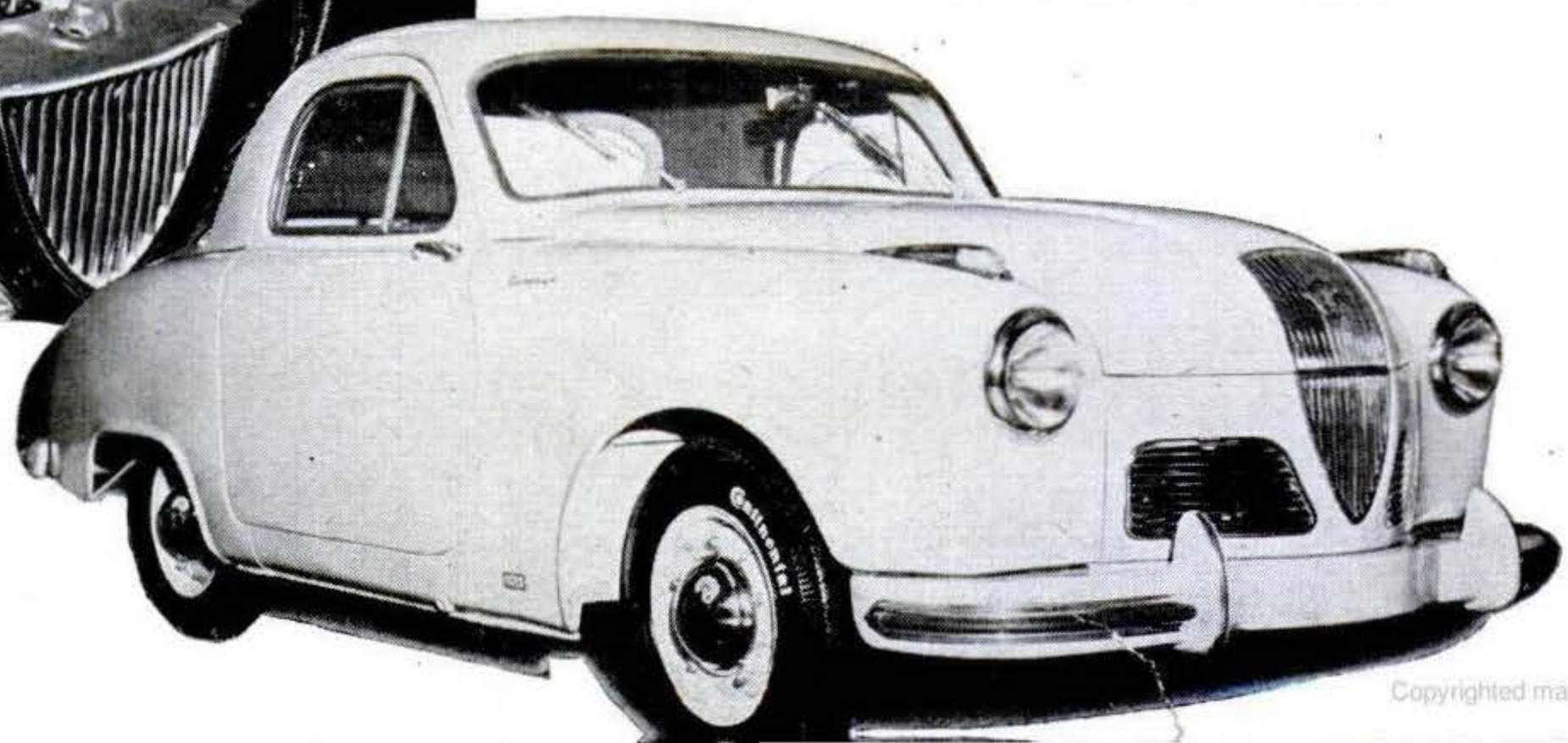
German Cars Make Comeback

FREE Germany is making automobiles again. Some are big and flossy—like the four-door convertible (above), a type you don't see around much these days. Others are small enough to park anywhere.

Horsepower ranges from 8½ to 115, and the number of cylinders from one to six.



Partner has 3-cylinder, 28-hp. engine (left) with radiator behind it. Though small-looking, car (below) seats five and sells for 5,775 Marks, or about $1,375. This Hanomag car and other automobiles on these pages were exhibited at International Automobile Show in Frankfort.



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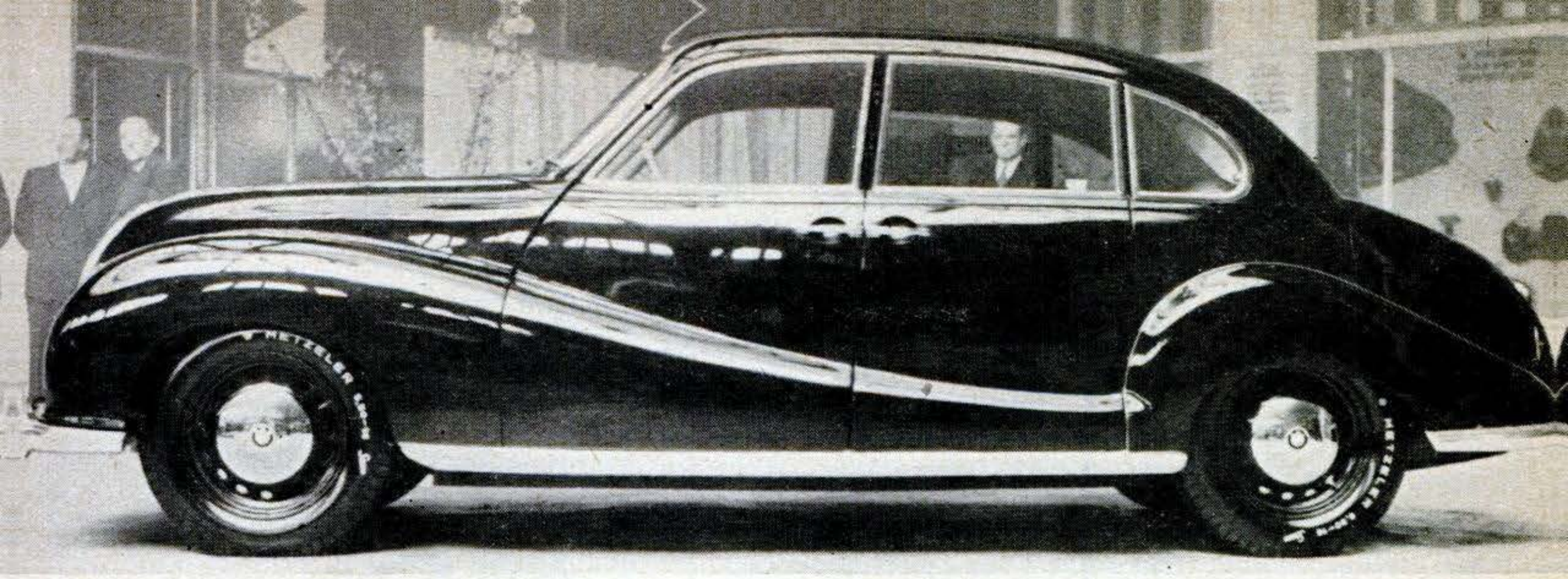
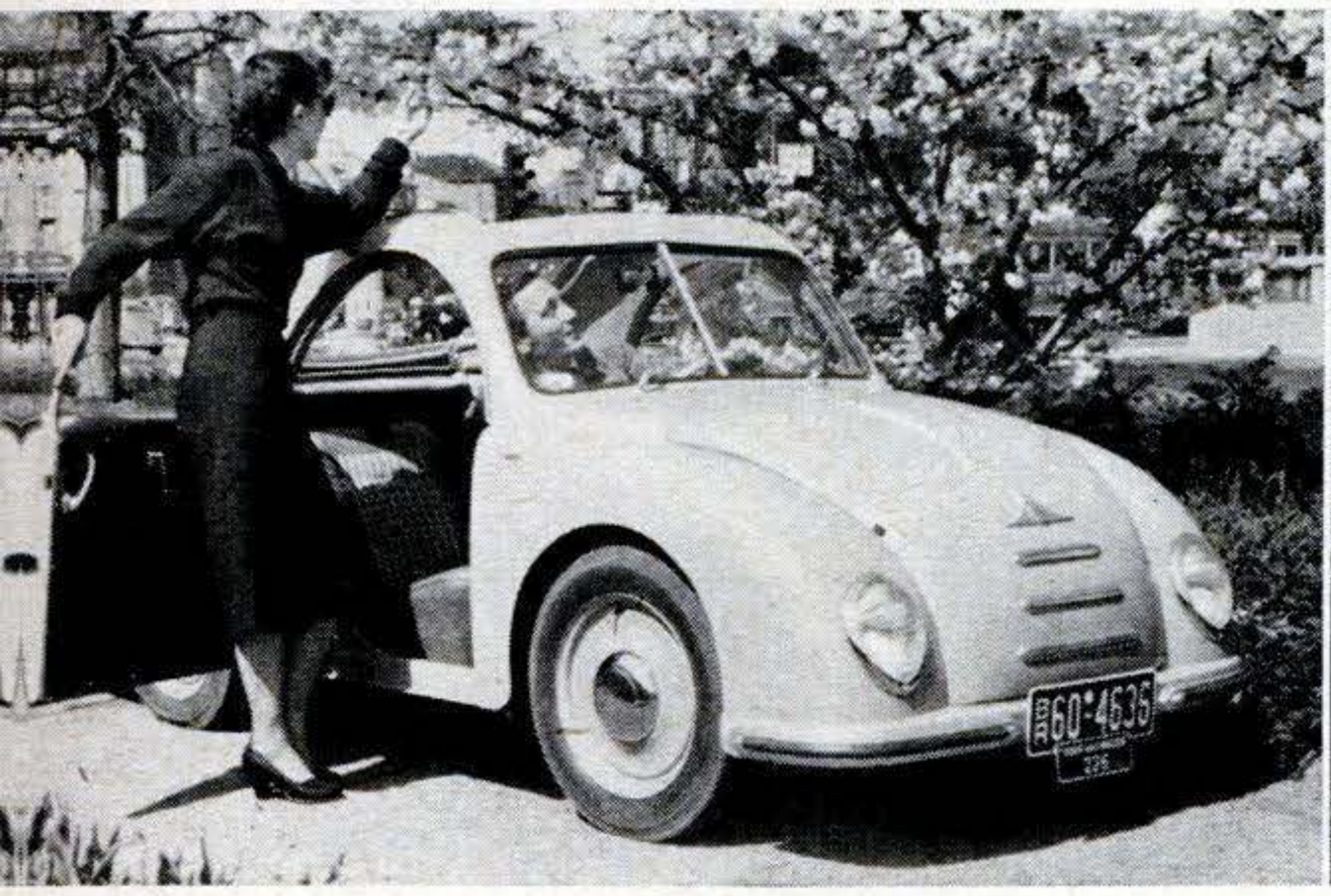
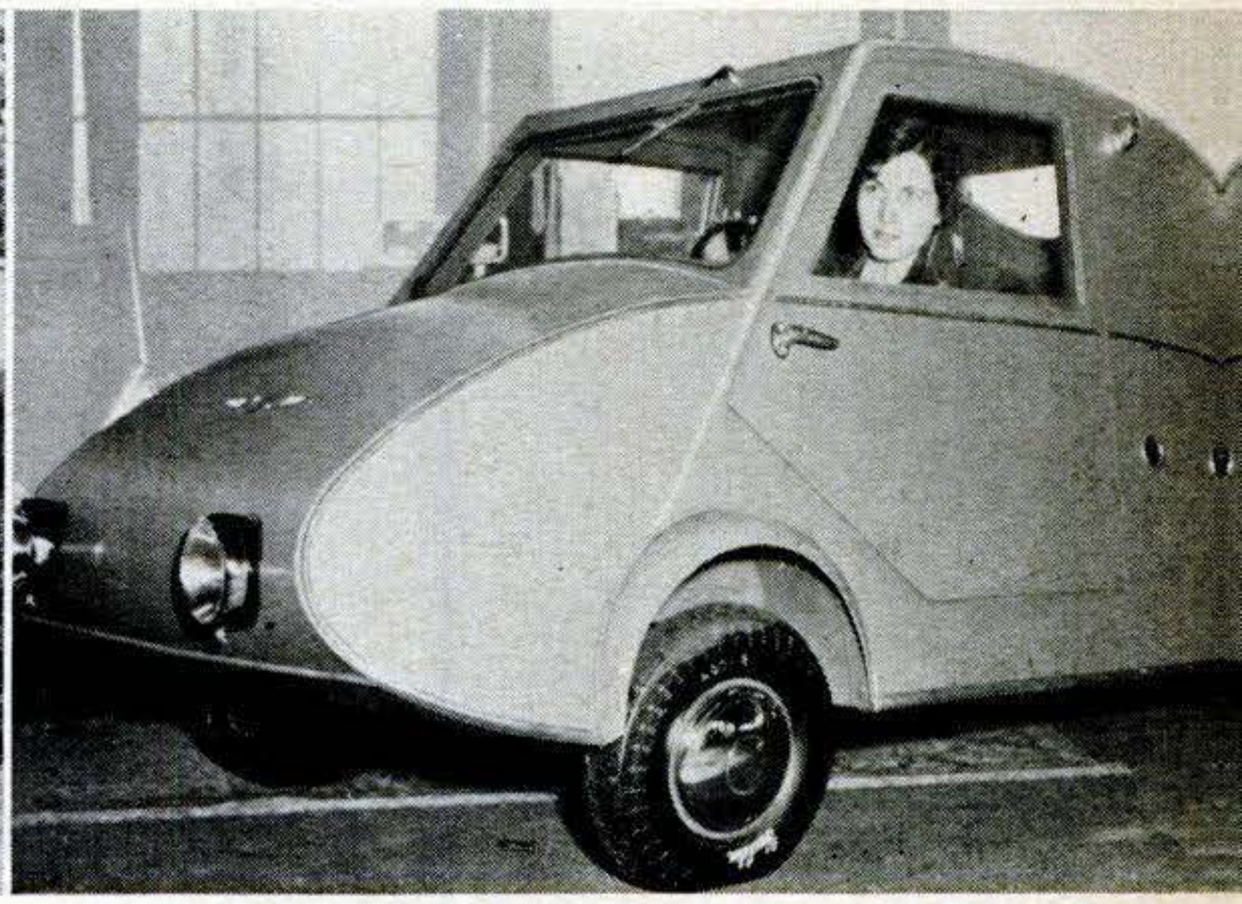


BMW 501 sedan, equipped with 60-hp. engine, is first car to come from company's new West German plant in Munich. Main plant at Eisenach, in Russian zone, has been nationalized. Six-cylinder engine drives car at top speed of 85 m.p.h. Production of 501 is scheduled for early 1952. Estimated price of 12,000 Marks amounts to about $2,850.

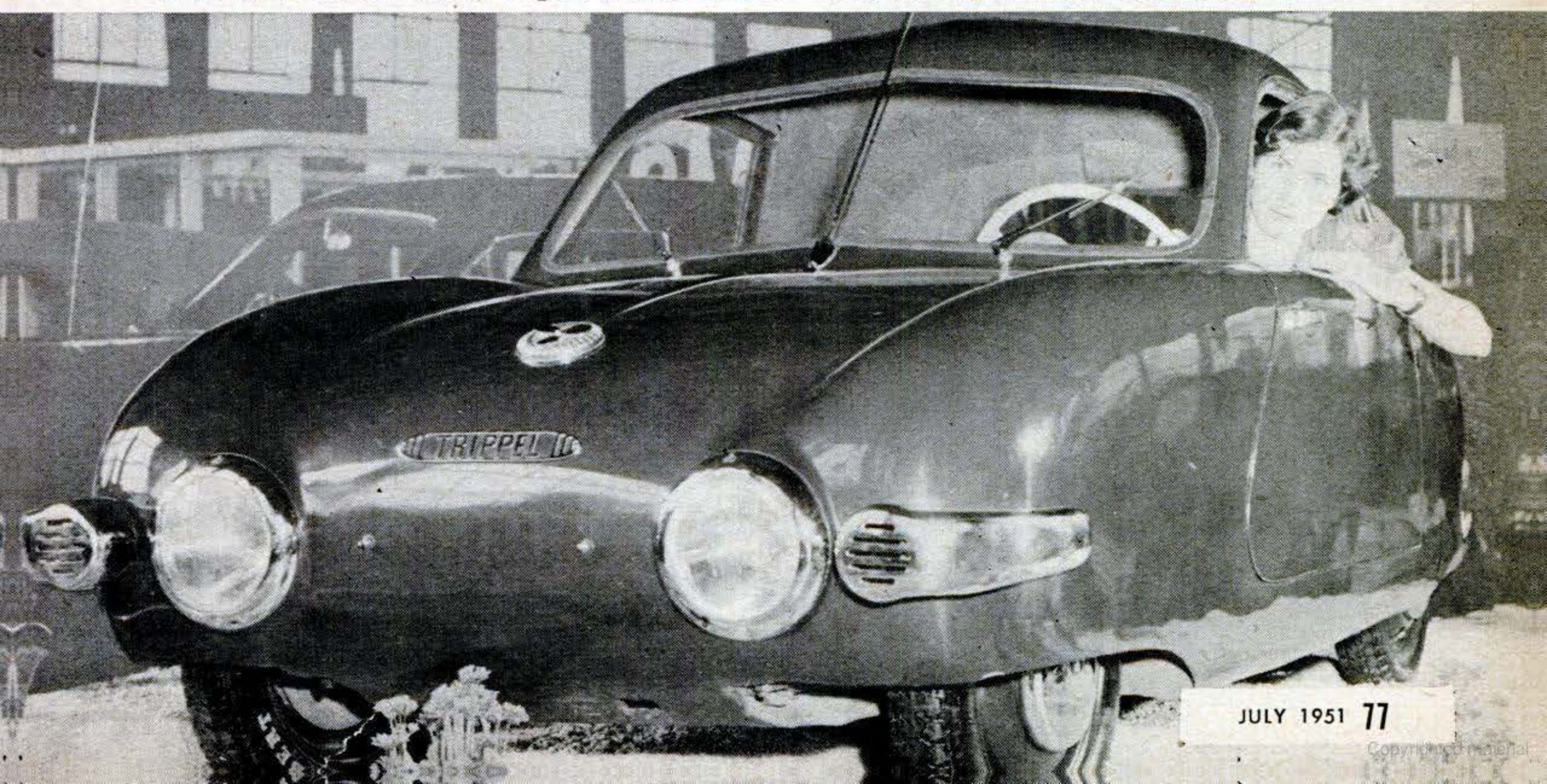


One of most popular cars in show was two-seater Champion 400, designed for low-price market. It has a very short wheelbase, gives 62 miles per gallon, and goes 55 m.p.h.



Even smaller than Champion 400 is sub-midget Fulda Mobil, with a one-cylinder, 8½-hp. engine. Car has only three wheels, can attain a speed of 40 m.p.h.

Trippel SK 10 is a snappy two-seater with a 2-cylinder, 18½-hp. engine. Made by Protek Co., Tuttlingen, car can do 70 m.p.h. Production is set for this summer. Price will be about $905. Note absence of conventional bumpers—maybe they just drive better over there.



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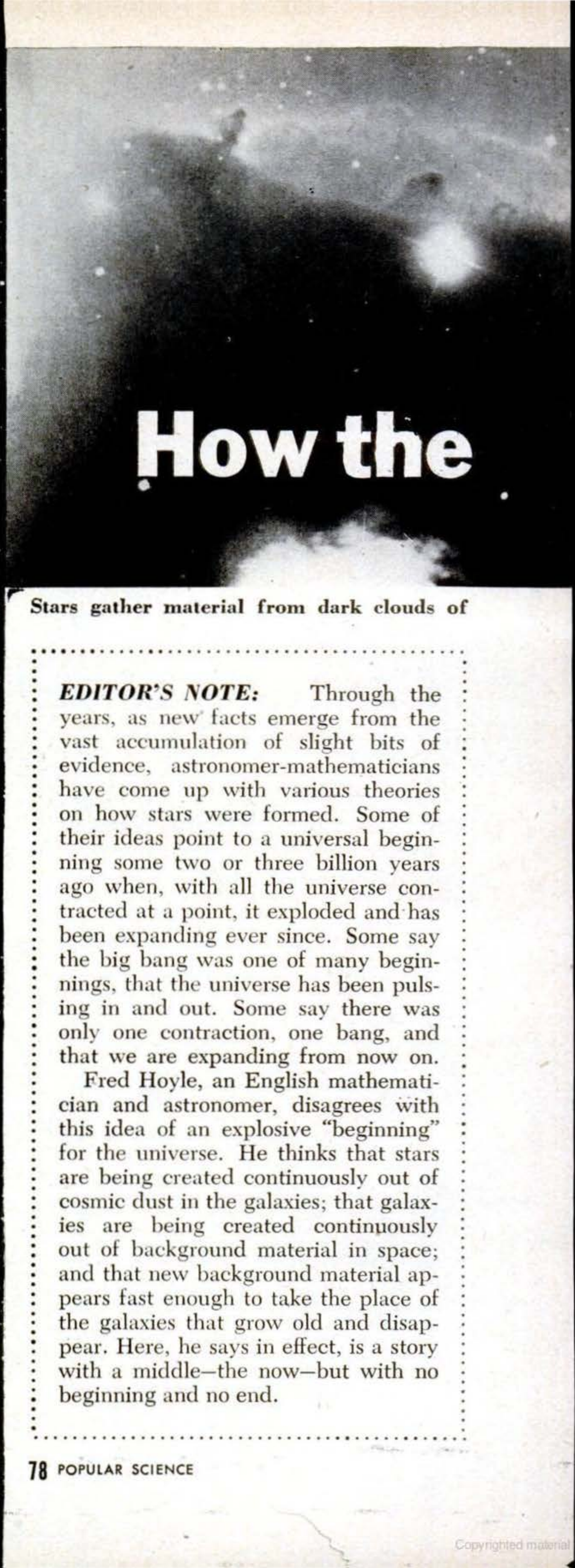
MT. PALOMAR 200-inch telescope, which can reach out one billion light years into space, took this picture of the Great Nebula in Andromeda. It is a galaxy like our own Milky Way. Millions of stars have formed and are forming from this rotating gas like droplets of water condensing on a cold glass.



How the

Stars gather material from dark clouds of

EDITOR'S NOTE: Through the years, as new facts emerge from the vast accumulation of slight bits of evidence, astronomer-mathematicians have come up with various theories on how stars were formed. Some of their ideas point to a universal beginning some two or three billion years ago when, with all the universe contracted at a point, it exploded and has been expanding ever since. Some say the big bang was one of many beginnings, that the universe has been pulsing in and out. Some say there was only one contraction, one bang, and that we are expanding from now on.

Fred Hoyle, an English mathematician and astronomer, disagrees with this idea of an explosive "beginning" for the universe. He thinks that stars are being created continuously out of cosmic dust in the galaxies; that galaxies are being created continuously out of background material in space; and that new background material appears fast enough to take the place of the galaxies that grow old and disappear. Here, he says in effect, is a story with a middle—the now—but with no beginning and no end.

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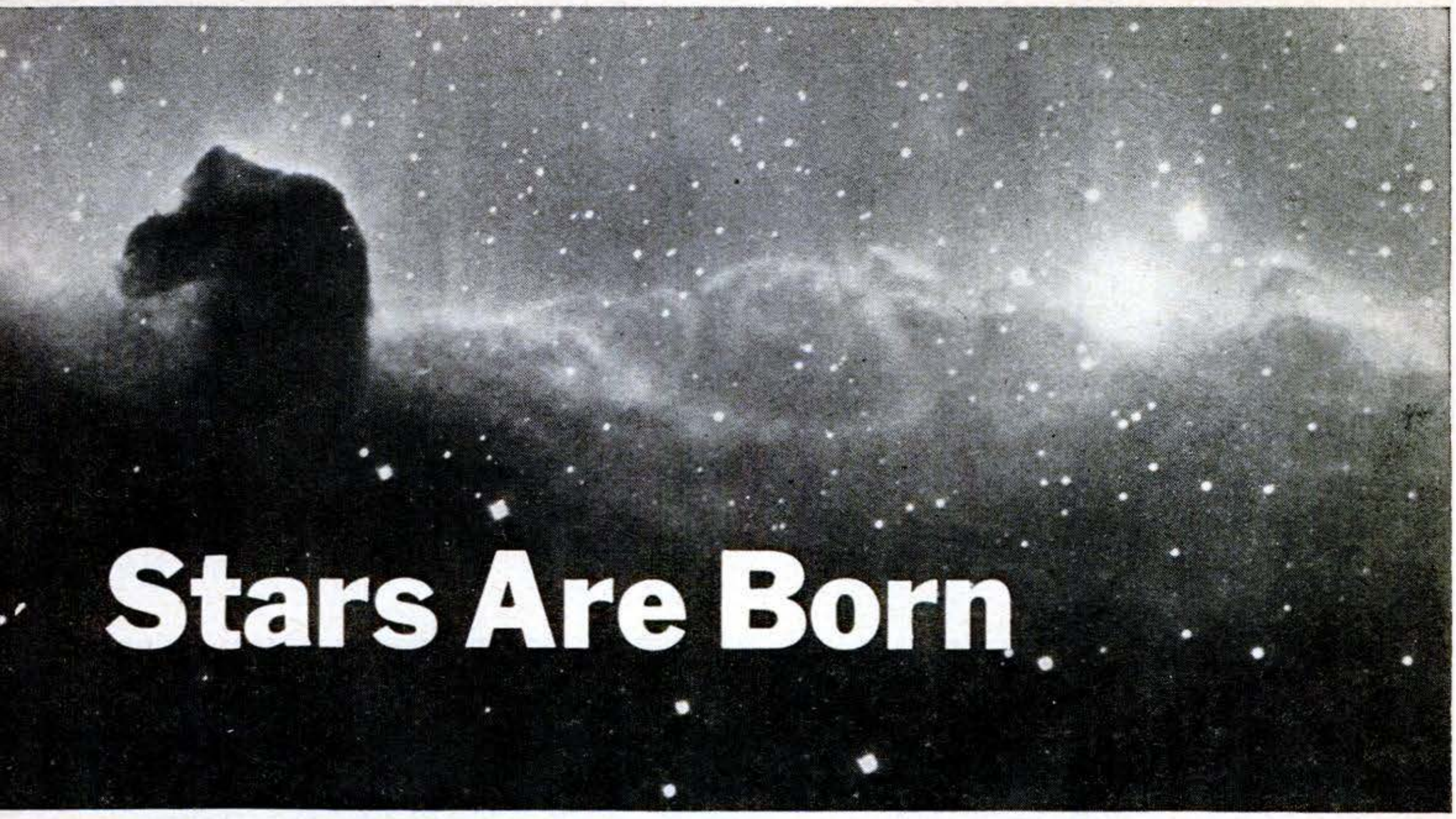


interstellar "fog" like Horse's Head in Orion constellation. Mt. Wilson Observatory Photo.

From the Book
"The Nature of the Universe"

By Fred M. Hoyle

(Copyright 1950, by Fred M. Hoyle; Published by Harper & Bros. $2.50)

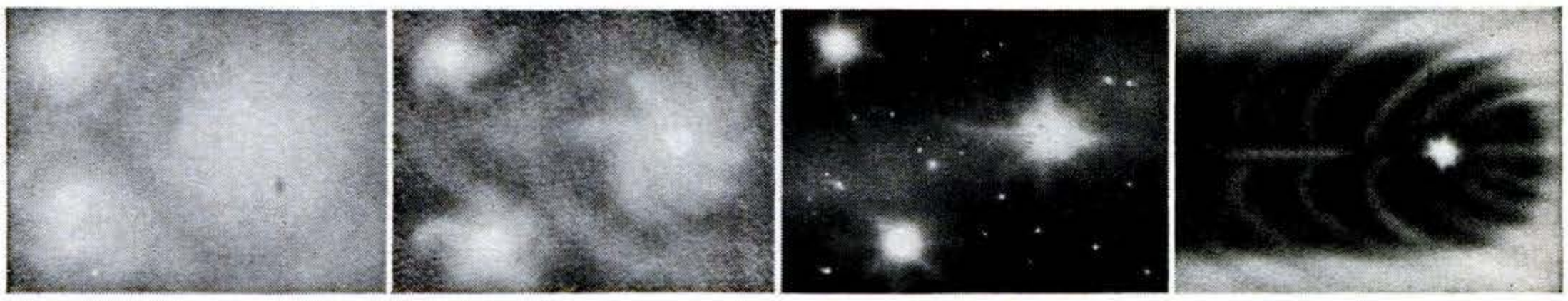
THE number of stars that actually can be seen at any given time with the unaided eye is only a little over 2,000. These stars all belong to what is usually called the Galaxy. Ours is not the only galaxy in the Universe. It is possible to pick up faint traces of other galaxies when you look at the night sky.

But all the stars you can see clearly belong to our Galaxy and their number increases very rapidly when you do not have to depend on the naked eye. *With even a small telescope you can distinguish about a million stars; with large telescopes, like the ones at Mt. Wilson, the number rises to well over a hundred million*—all within this one Galaxy.

The Galaxy is shaped like a disk. When you look at the Milky Way, you are looking *along* the disk, and so you see a large number of distant stars. But when you look at other parts of the sky, you are looking *out* of the disk, and you then see only a comparatively few stars—these are just the ones that happen to lie close to us. It is because of their nearness that so many of these stars appear bright.

You Can See 1,000 Light Years

When you look at the Milky Way with a small telescope you can see to a distance of more than a thousand light years. Perhaps



HOW A STAR GROWS. A cloud of thin, cold interstellar dust begins to clot and rotate as it shrinks by gravity. Shrinking keeps up until star cloud compresses enough to glow with energy of atomic transmutations. As star grows to maturity, it draws in more interstellar material, like a celestial vacuum cleaner.

Copyrighted material

the most important feature of the New Cosmology is the realization that *this stellar space is not empty at all.* Throughout the Milky Way there is a diffuse gas, usually called interstellar gas.

Although this gas is so rarified and although it consists so largely of hydrogen, it isn't all quite pure and it isn't uniformly transparent. For it contains clouds of tiny dust particles, which are a great nuisance to the observational astronomer because they produce a sort of fog that limits his vision whenever he tries to look deep into the Milky Way. *Thirty years ago it was thought that when we look out at the Milky Way we see the whole of the Galaxy. But we now know that this view is hopelessly wrong. The fog I've just mentioned cuts down our vision so much that, instead of our being able to see the whole of the Galaxy, we see only about a hundredth part of it.*

Only 10,000 Atoms in a Matchbox

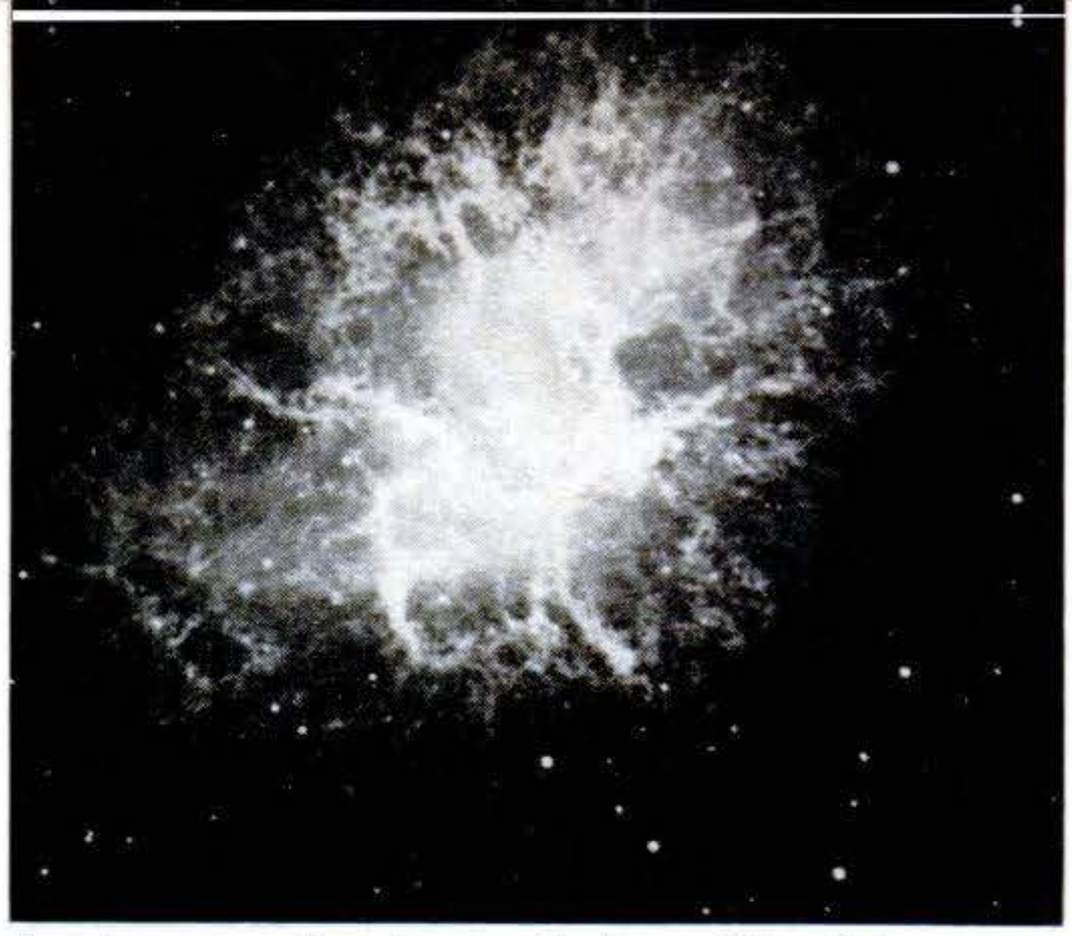
The interstellar gas is certainly extremely rarified. On an average over the whole Galaxy a large matchbox full of it would contain only about 10,000 atoms. This may be compared with the material in a star, like the Sun, where on the average a matchbox full would contain about a hundred million million million million atoms. Yet, in spite of this enormous difference in density, *the total quantity of material comprising the whole interstellar gas seems to be appreciably greater than the material in all the stars put together.*

The reason for this surprising result is that the interstellar gas occupies a truly vast volume. The crucial consequence to be drawn from this new cosmological development is that it is *the interstellar gas, not the stars* that *rules the Galaxy.* It controls the motion of the stars. It also controls their birth and the way in which they grow.

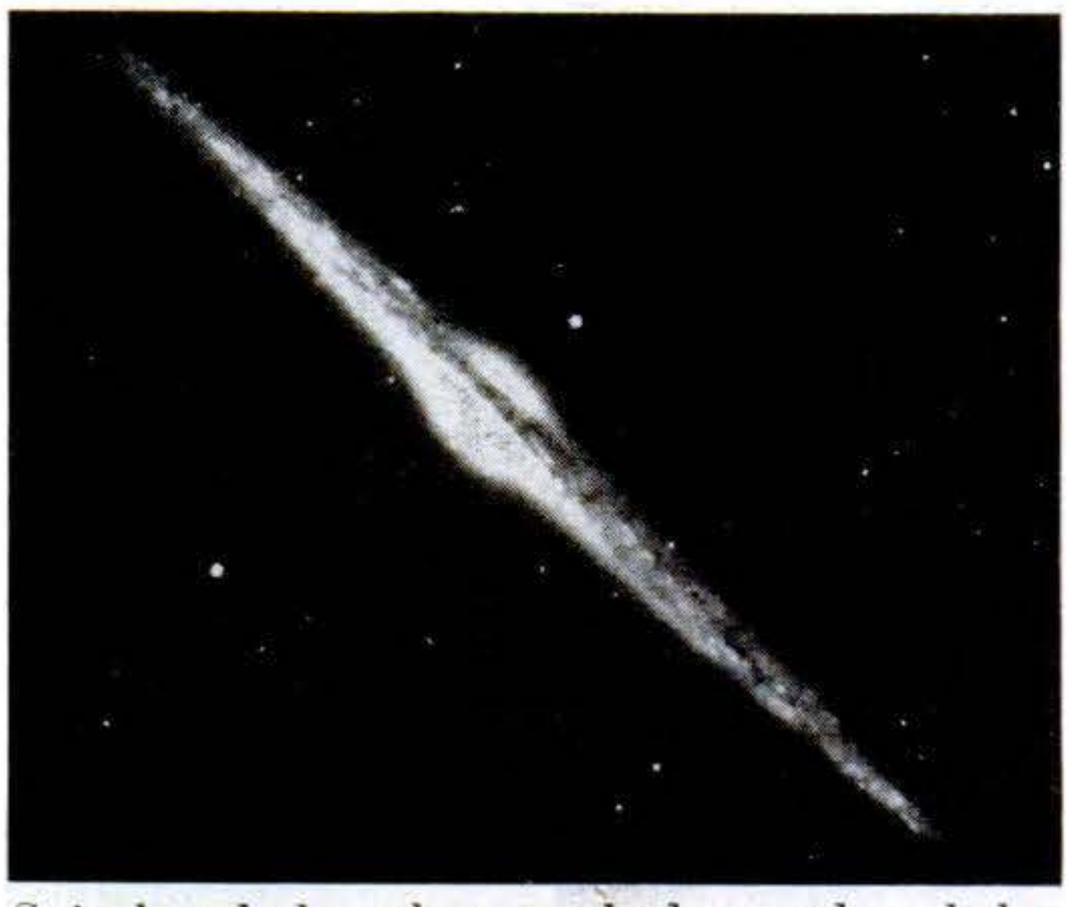
Astronomers are generally agreed that the Galaxy started its life as a rotating flat disk of gas with no stars in it. There would everywhere be small disturbances in the detailed motions of the various bits of gas, especially near the edge of the disk. To assume a complete absence of such disturbances would be rather like supposing that the flow of water in a whirlpool could be entirely smooth, being devoid of ripples and small eddies.

Now how does a rotating disk of very diffuse gas give birth to compact stars? Well,

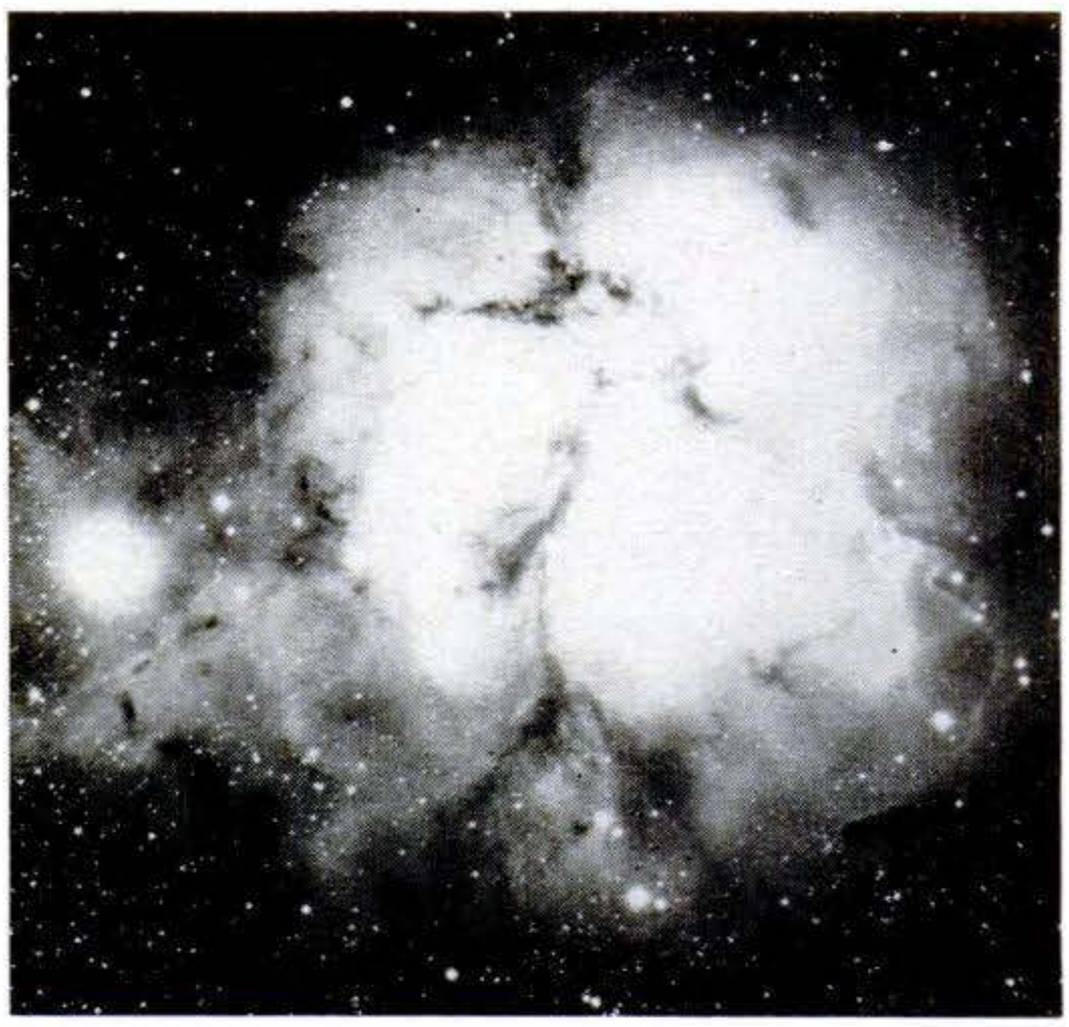
[Continued on page 202]



A big star dies by exploding, like this supernova, the Crab Nebula, first seen in 1054 A.D. The fate of a small star is to grow old and lifeless. Mt. Wilson Photo.



Spiral nebula, photographed on edge, helps confirm our notion that galaxies, like our own Milky Way, are shaped something like a fried egg. Yerkes Observatory Photo.



You are looking toward center of Milky Way, forever hidden from us by great star clouds that lie in constellation of Sagittarius, the Archer. Mt. Palomar 200-Inch-Telescope Photo.

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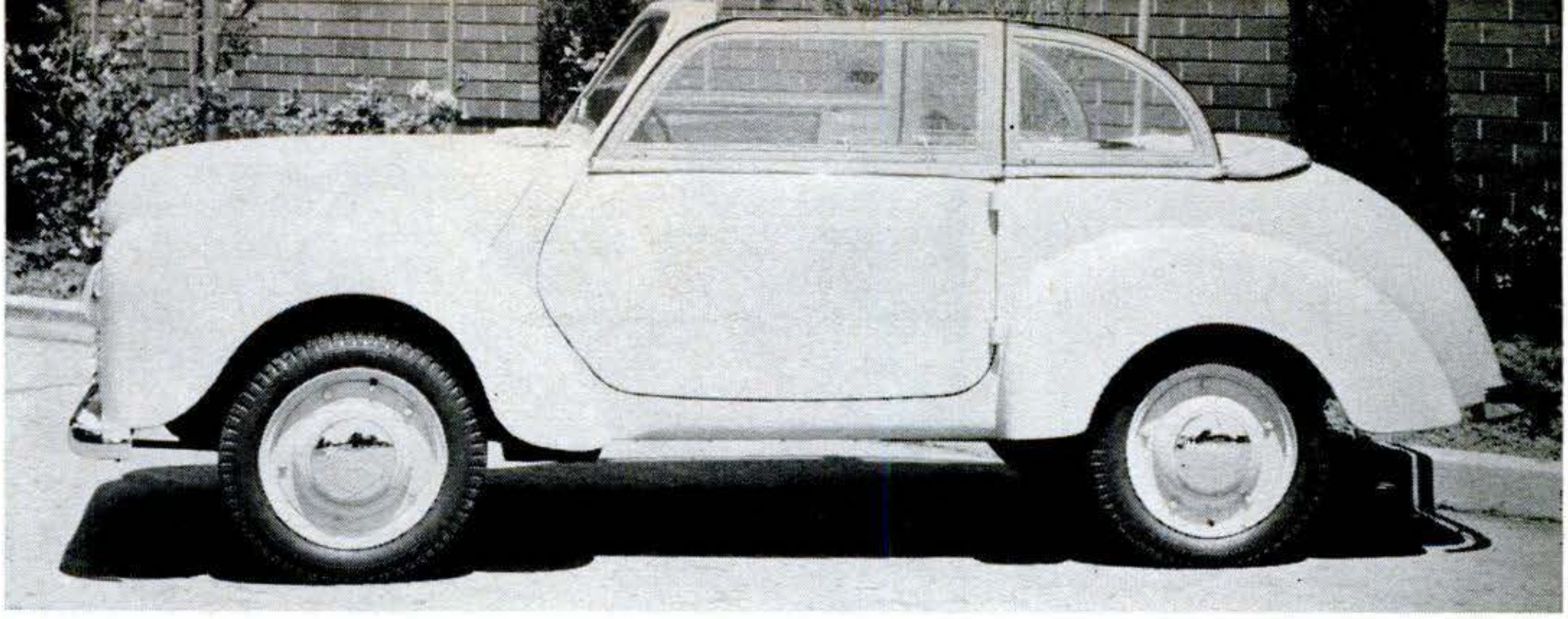
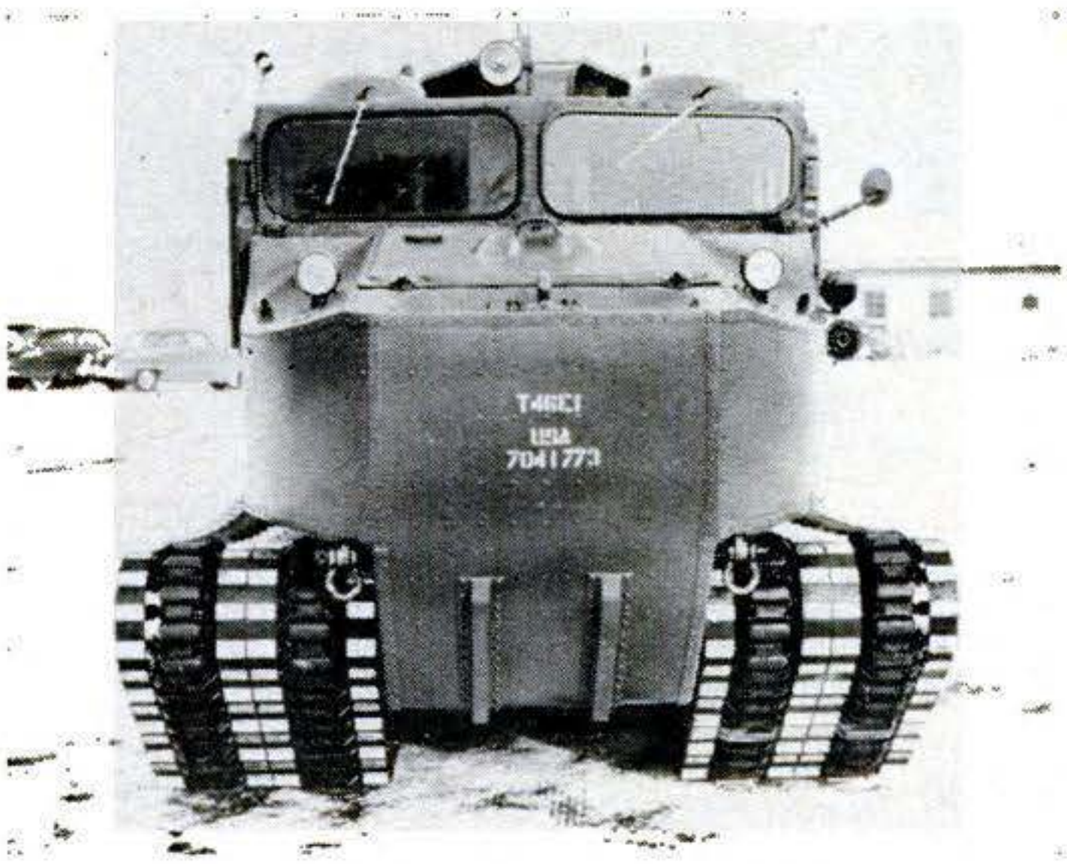


Aussie Car Is Easy on Eyes—and Gas

AN UNUSUALLY economical new family car—it gets 60 miles to the gallon—is being produced in Australia. Called the Hartnett, the two-door convertible has a two-cylinder engine and sells for the equivalent of about $1,300 in U. S. money. The side curtains are removable.

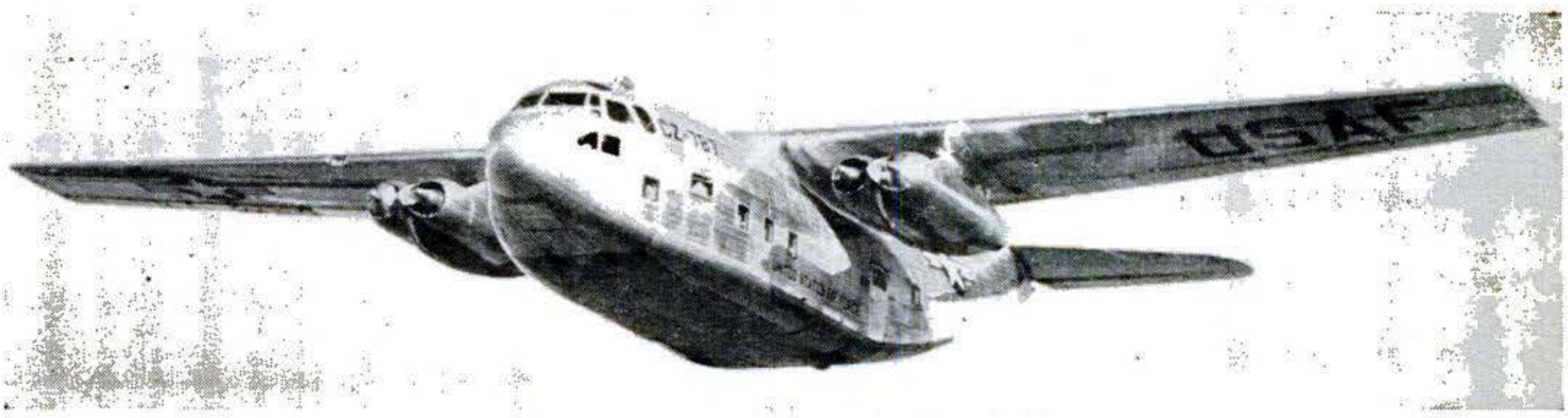


Army Amphib Is Like Floating Tank

THIS new Army amphibious carrier is equipped with the wobble-stick control and crossdrive transmission being used in the latest tanks. With a full crew, the armed vehicle can travel 30 m.p.h. on land. It turns around in its own length. The same tracks that move it on land also propel it through water, like paddle wheels.

Target Knife Balanced for Throwing

BALANCED especially for throwing, this target knife is a duplicate of those used by natives in Malayan jungles. Made of tempered steel, the blade has a special rust-resistant finish. The grip end is bound in waterproof tanned cowhide. It's priced at $2.00 by the Wham-O Manufacturing Co., of Alhambra, Calif.



Jets Power Troop Transport

THE photo above shows the new jet-powered version of the Air Force Chase XC-123 on its first flight. The 77-foot troop and cargo transport now carries four GE J-47 turbojets, each rated at 5,200 pounds' thrust, making a total of 20,800 pounds of push for the giant sky freighter.

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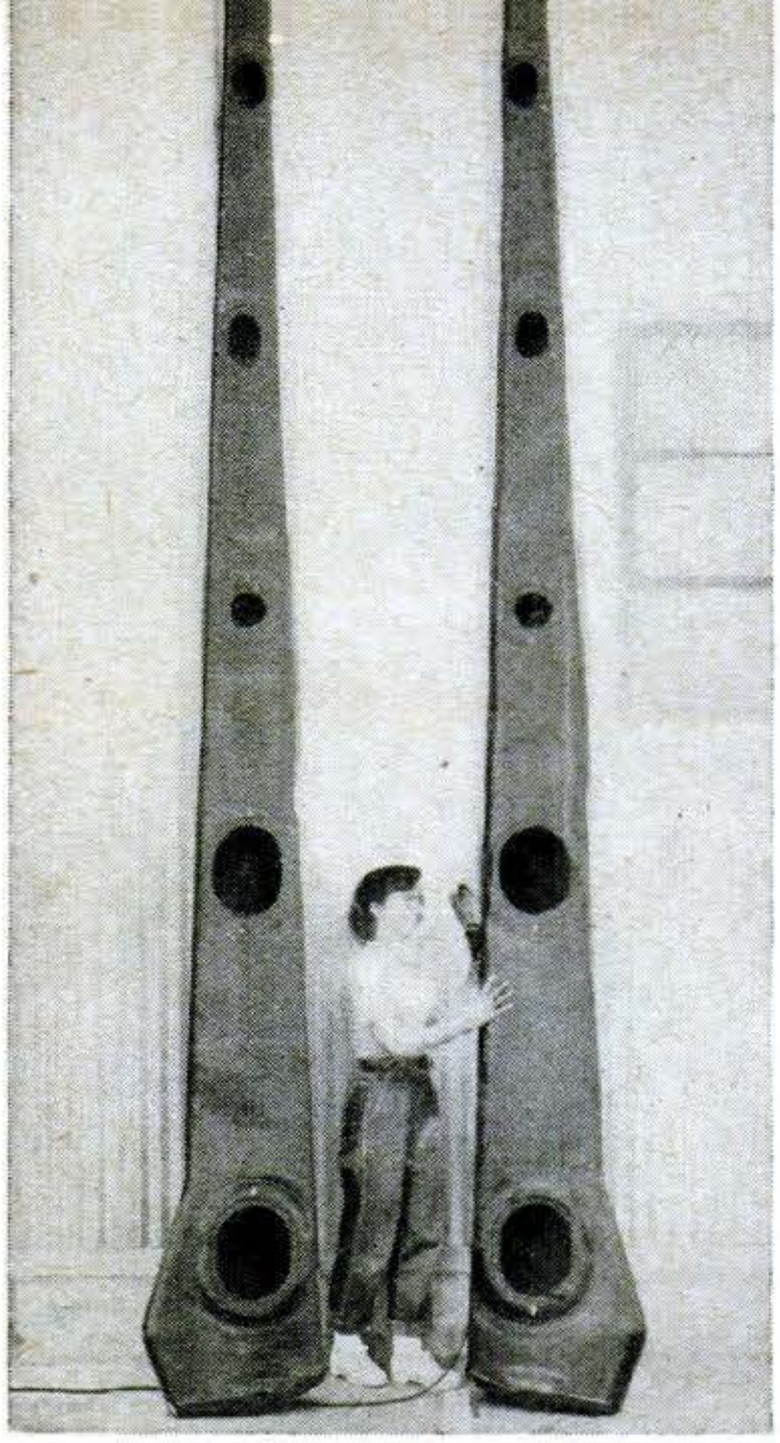
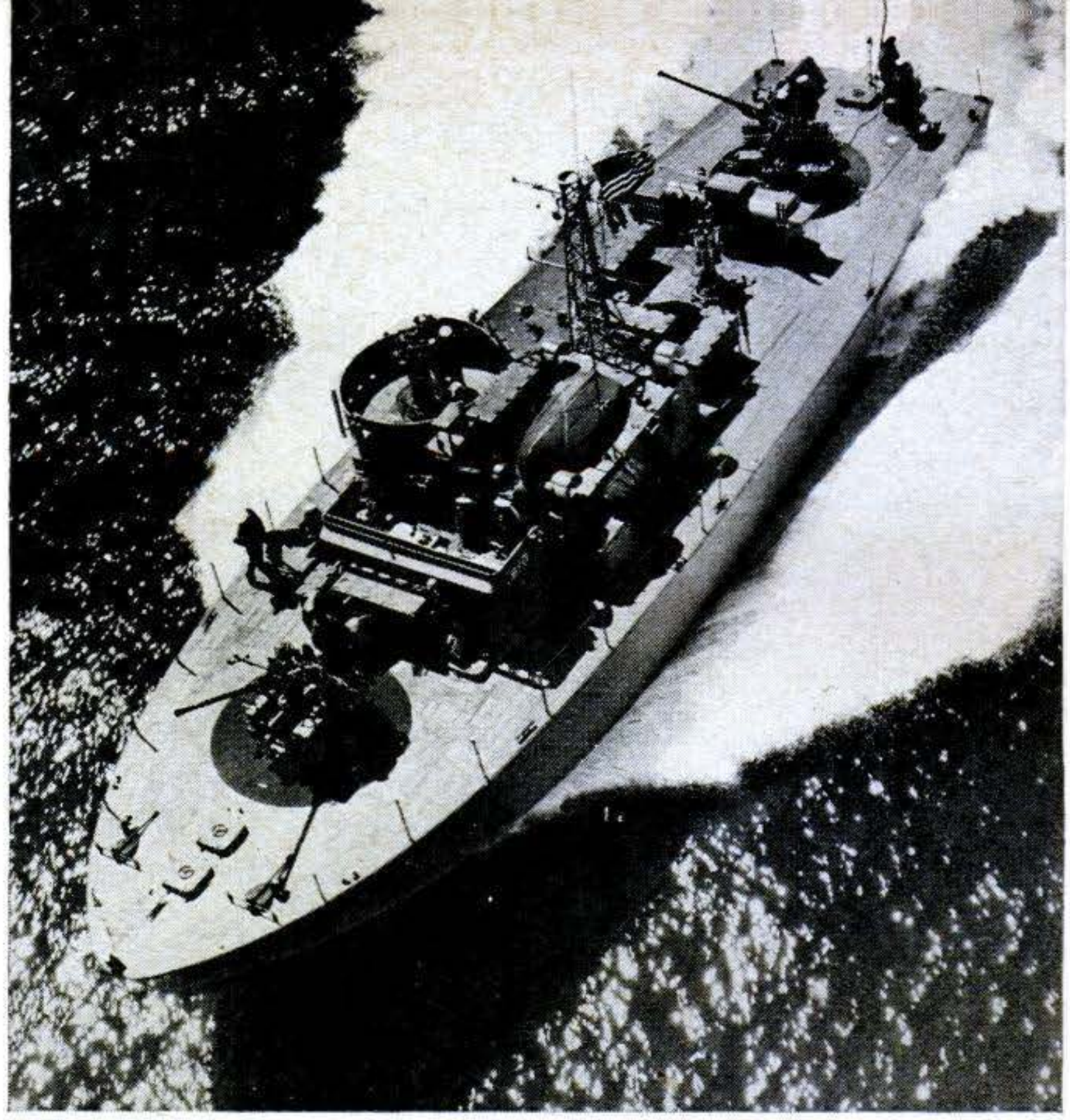


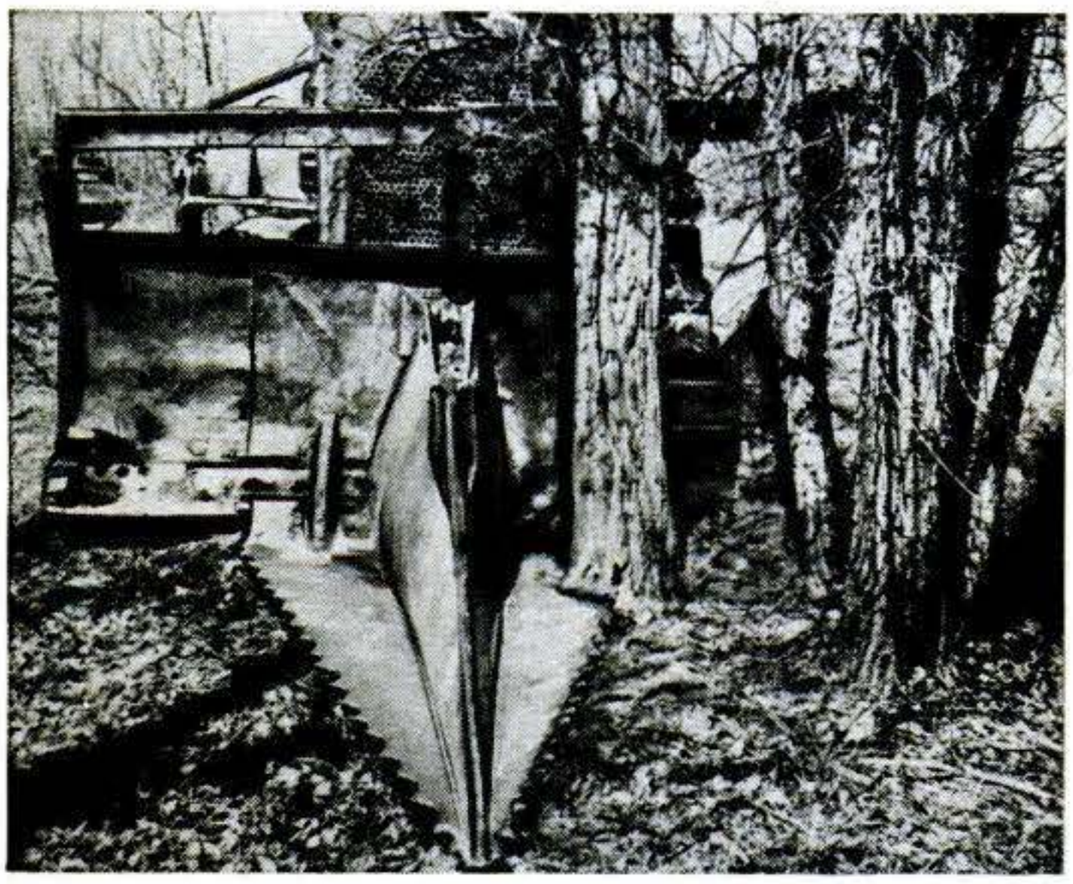
Skinny Tanks Fit Jet Wing

THESE odd-shaped gasoline tanks fit in the leading edge of a jet fighter's wings. They are made of self-sealing rubber fabric, which automatically plugs up bullet holes. The cells shown above are one of many unusual shapes made by Firestone for the Air Force.



New PT Boat Packs a Sharper Sting

MAKING a high-speed run, this aluminum-hulled patrol-torpedo boat is bigger, faster, and packs more wallop than its forerunners, the renowned "expendable" mosquito fleet of World War II. The Navy's new PTs range in length from 95 to 105 feet, with a 25-foot beam. Propelled by four aircraft-type engines, the heavily armed craft can cruise 550 miles before refueling. The vessels, half welded and half riveted, were built at the Bath Iron Works, Bath, Me.



Mechanical Swordfish Fells Trees

A SAW that looks like a huge swordfish can slash through a 24-inch tree with one stroke. The double-edged six-foot blade is mounted on a bulldozer that pushes it through the tree trunk close to the ground. It does the work of five chain-saw crews in clearing land for Boysen Dam in Wyoming.

Watch-Charm Pistol Fires Blanks

WATCH out! The tiny pistol dangling from the lady's charm bracelet may really shoot. This Japanese miniature, said to be the world's smallest, works like a real gun and does fire—but only blanks. The "Little Atom," which breaks, loads, and cocks, is imported by G&S Mfg. Co., Nashville.

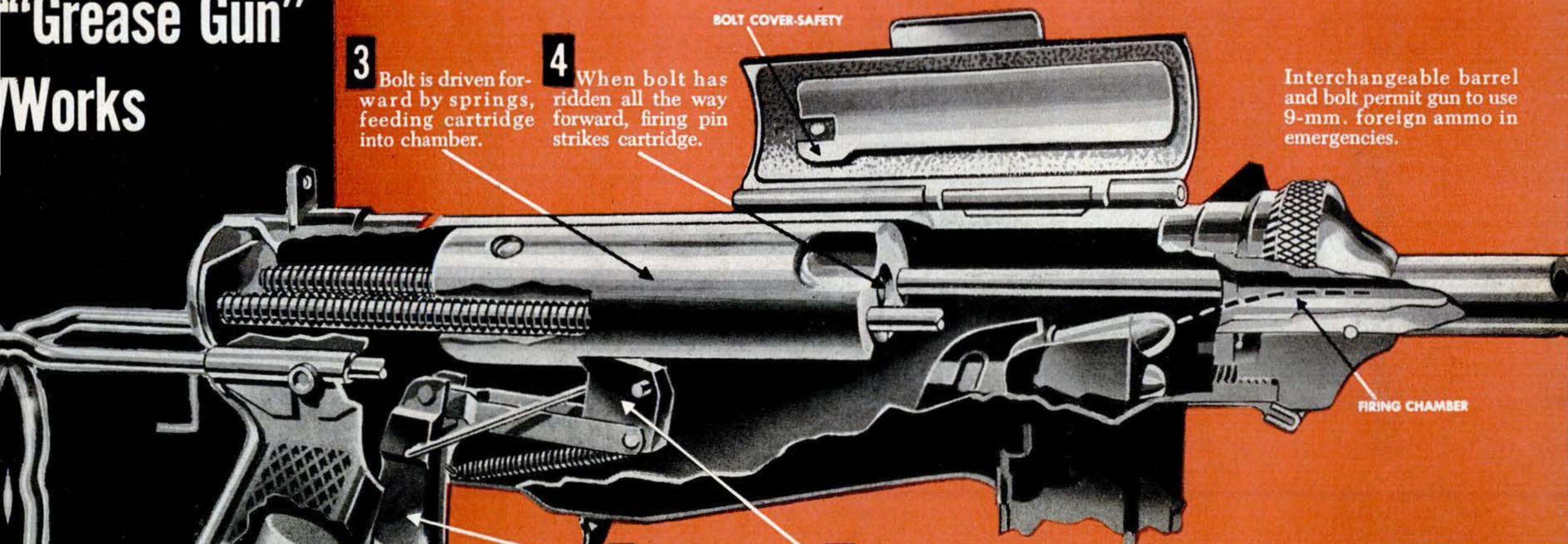
Know Your Weapons!

Modern weapons are more than highly specialized tools for fighting men. They are also extremely ingenious machines. Beginning with the famed "grease gun"—on the opposite page—POPULAR SCIENCE is presenting a series of cutaway drawings showing how the principal U. S. light weapons are made and work. Next month: the Garand rifle.

Copyrighted material

How the "Grease Gun" Works

THE M3A1 submachine gun, called the "grease gun" because it looks like one, is cheap and easy to make. It uses stampings instead of forgings wherever possible, and the bolt rides on two guide rods, eliminating close tolerances. The gun will keep firing as long as the trigger is held back and there are cartridges in the chamber. The bolt cover, open when firing, acts as a safety when closed. The gun fires a .45-caliber slug.



3 Bolt is driven forward by springs, feeding cartridge into chamber.

4 When bolt has ridden all the way forward, firing pin strikes cartridge.

Interchangeable barrel and bolt permit gun to use 9-mm. foreign ammo in emergencies.

1 Squeezing trigger is first step in firing cycle.

2 Sear is depressed, disengaging notch in bolt.

Can in butt holds lubricating oil.

5 As cartridge fires, pressure rams bolt back against springs for next shot. Empty shell, held on bolt by extractor, is kicked out when it strikes ejector.

Know Your Weapons

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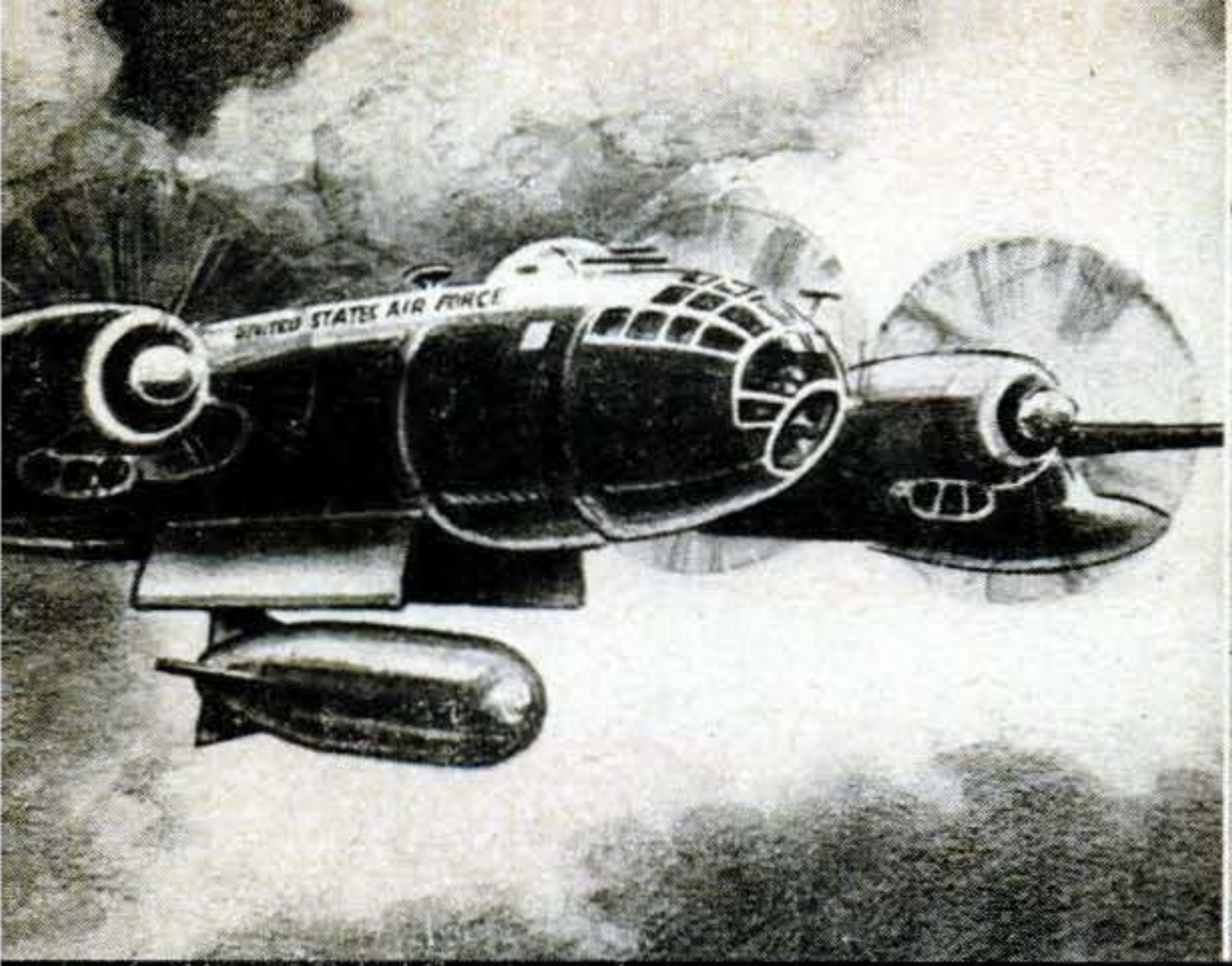
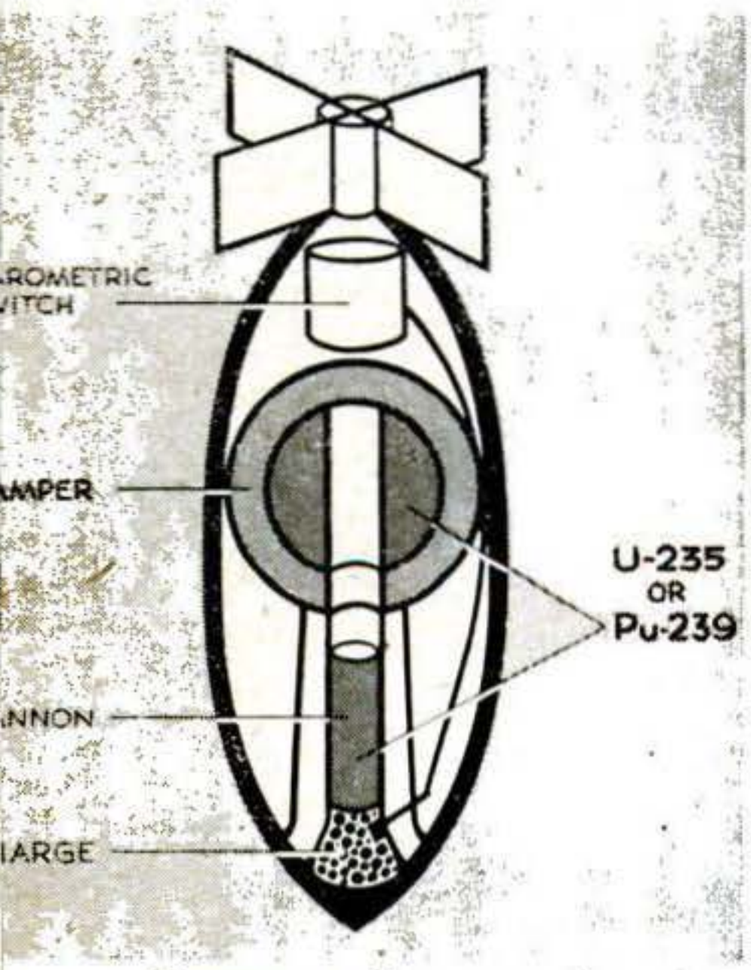


LOOK drawing by Jim Berryman, Copyright Cowles Magazines, Inc.

***Look* magazine** drawing by a cartoonist, Jim Berryman, shows A-bomb's exterior as he imagines it. He guesses length to be 20 feet; diameter, 10 to 12 feet; weight, five tons.

TIME diagram by R. M. Chapin, Jr., Copyright Time Inc., 1951.

***Time* magazine** diagram visualizes recent spy-trial testimony on A-bomb's supposed design. "Implosion" (inward explosion) compresses plutonium into ball; neutrons detonate it.



POPULAR SCIENCE drawing of 1945 follows hint in Smyth report; gun shooting part of A-charge against rest could be detonator.

Here are pictures of ATOM BOMBS . . . none of them accurate

SOMEDAY photos of the A-bomb will be published, and there may even be models of it in store windows, the Atomic Energy Commission's chairman, Gordon Dean, has predicted. Until then, guesses about its appearance and inner mechanism will be as varied as the half-dozen illustrations on these pages.

This "A-bomb picture gallery" compares efforts of a number of publications, including POPULAR SCIENCE, to visualize the weapon from the meager non-secret data available. How widely the conceptions differ is apparent. Authorities refuse even to indicate which of the many versions is least wrong.

***Life* magazine** photo of model of imaginary detonator has rocket, instead of gun, bringing together saw-toothed hemispheres of uranium or plutonium.

Photo by LIFE photographer Fritz Goro, Copyright Time Inc.

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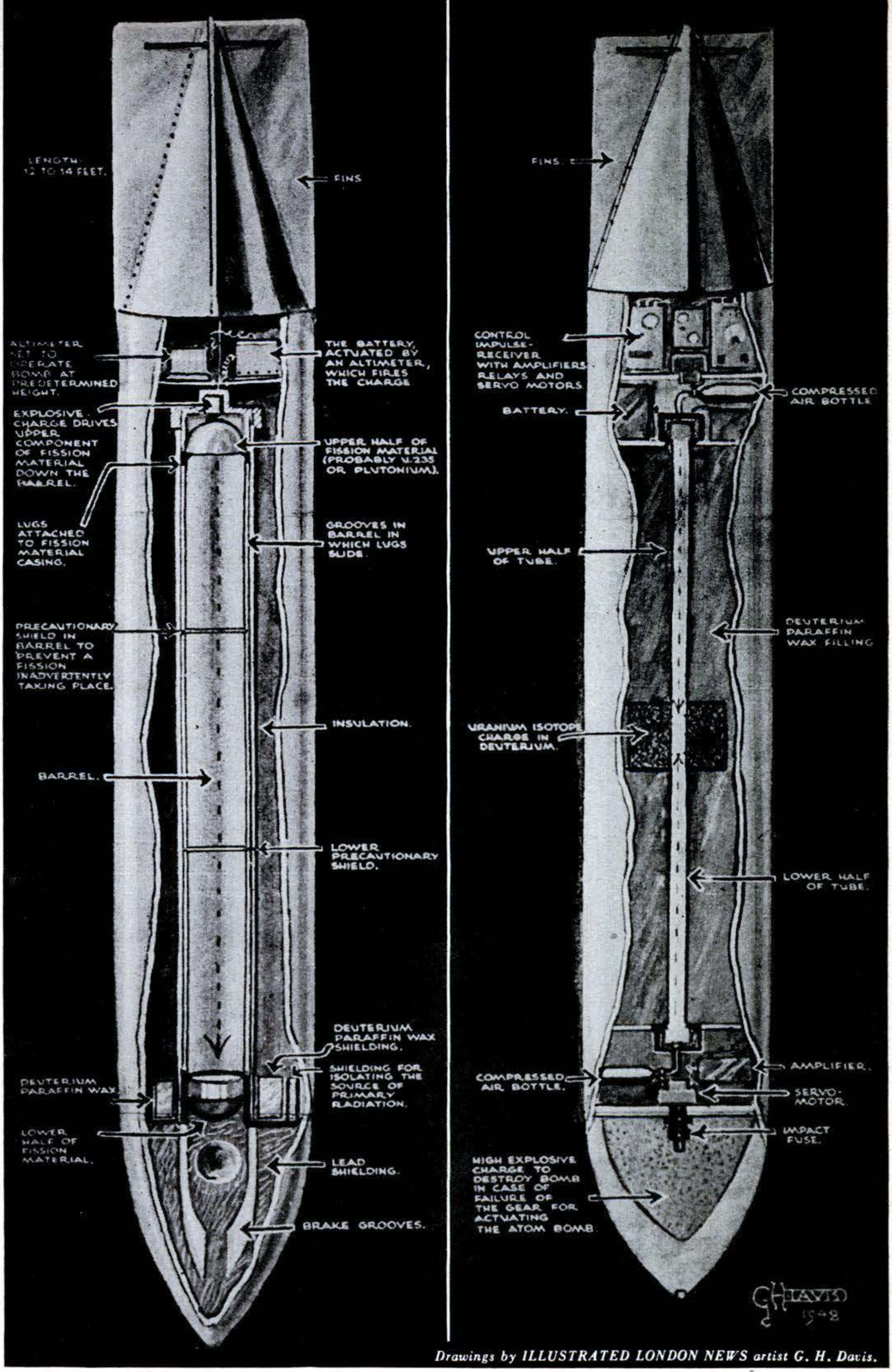

Drawings by ILLUSTRATED LONDON NEWS artist G. H. Davis.

Illustrated London News drawings: British concept, left, shows two-ton, 14-foot bomb that uses "gun" principle; shields drop, releasing detonating neutrons. Russian version, right, forces neutron-emitting materials into tube with compressed air to touch off preassembled uranium.

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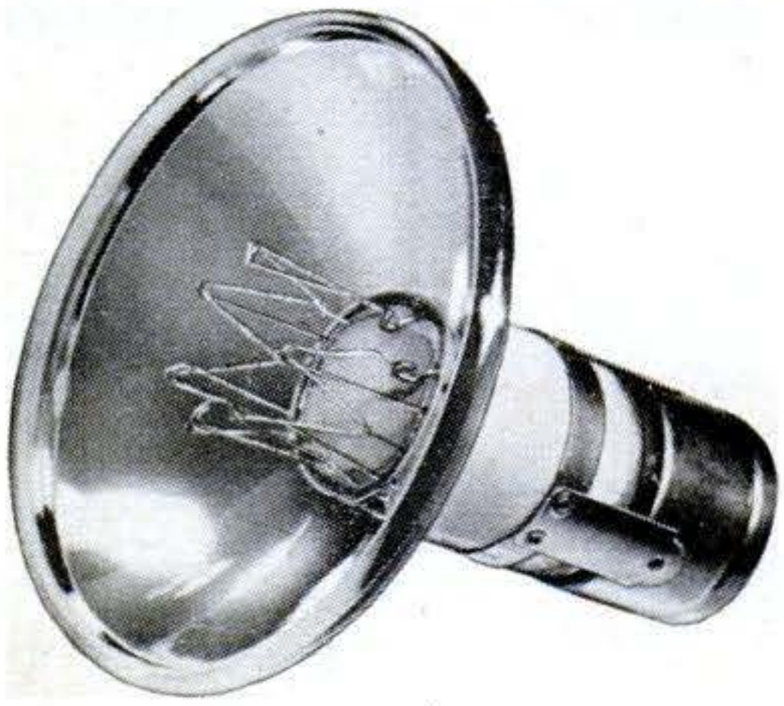
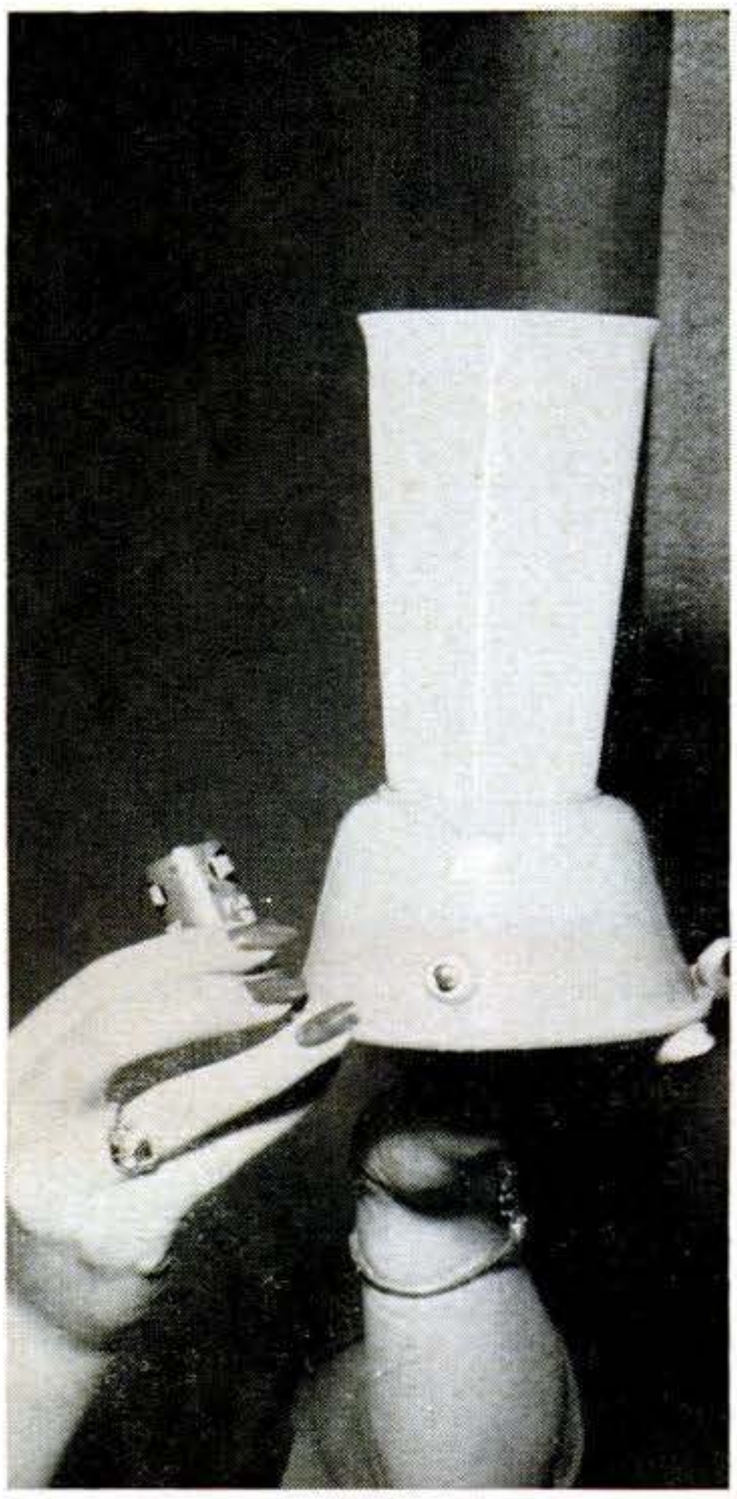
Aids to Modern Living



Cook with a Lamp. Some kitchen stoves will soon be cooking with infrared rays from an instant-heating, 1250-watt lamp. Developed by Sylvania, it can be used on any electric range. The tough glass cover cleans easier than coils.



Mixer Runs on Batteries. This plastic, 12-oz. mixer runs on three flashlight cells. Lightweight and shockproof, it's safe for children and handy for campers. Rowe Industries, Sag Harbor, N. Y.

Tool Saves Fizz. It's a cinch to recap bottles with this tool. A built-in plunger does the job. Rounded head is an opener. From Mayfair Mfg. Co., Chicago, 98¢.

It's in the Bag. But no one will suspect it's your lunch. Lower compartment carts the calories and top section totes purse and makeup. Made by Landers, Frary and Clark, New Britain, Conn.

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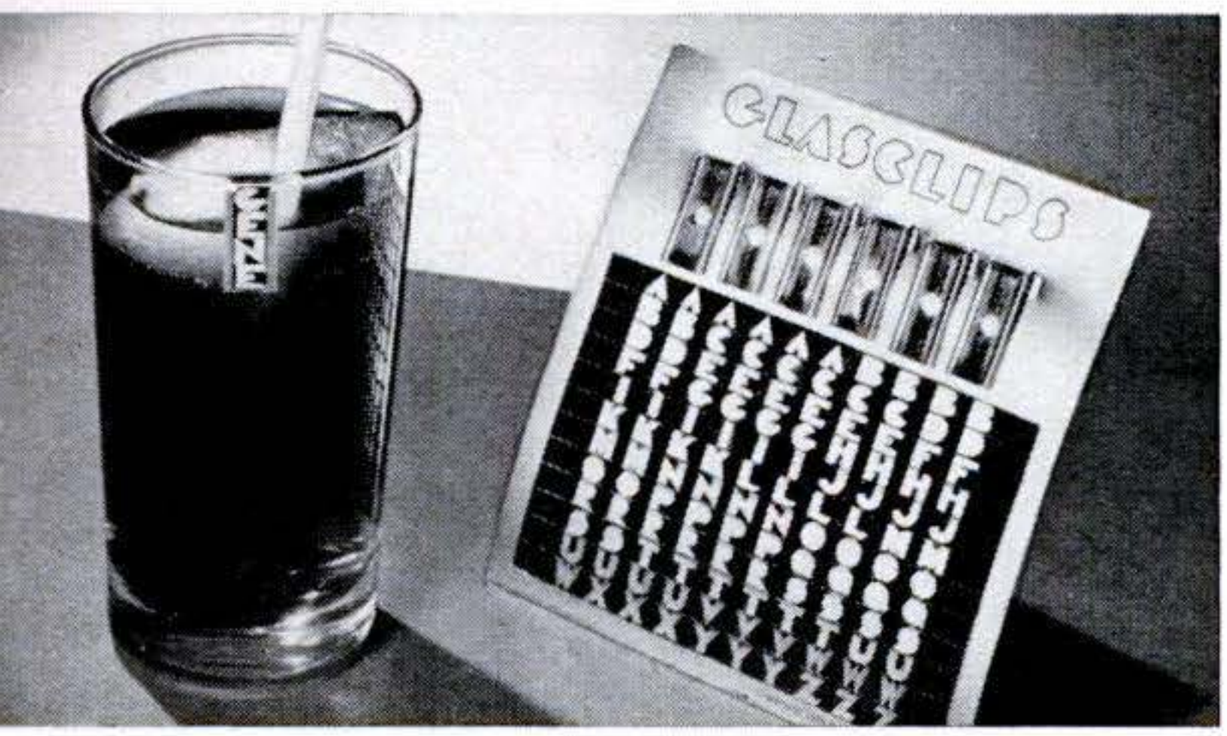
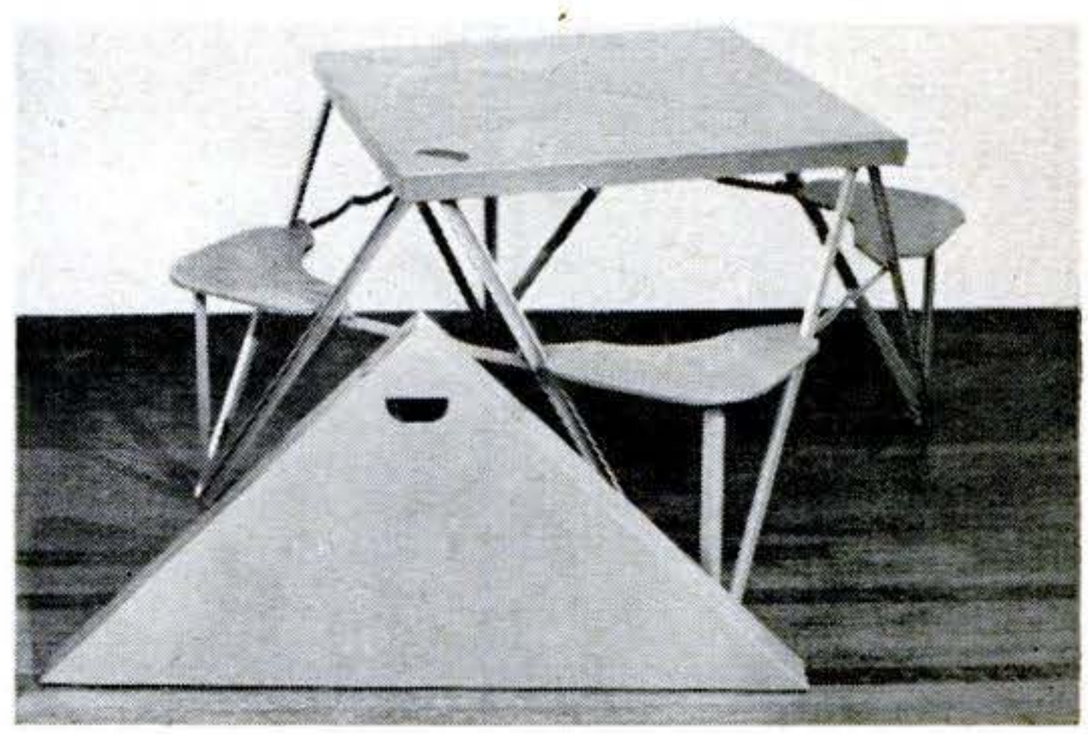
Table Model Stands Alone. Attach the four legs and this Motorola table-model TV set becomes a console. The 20-inch screen is curved to reduce glare. About $400.

Make Your Own Instant Coffee. The Filtron (above) turns regular ground coffee into a liquid concentrate. You just put the fresh coffee into the device, fill the top with cold water, and, overnight, the base will fill with liquid coffee extract. Refrigerated, the concentrate will keep for months, ready for instant use. Using cold water avoids the bitter taste caused by boiling coffee. From Helmco-Lacy, Chicago, for $19.50.

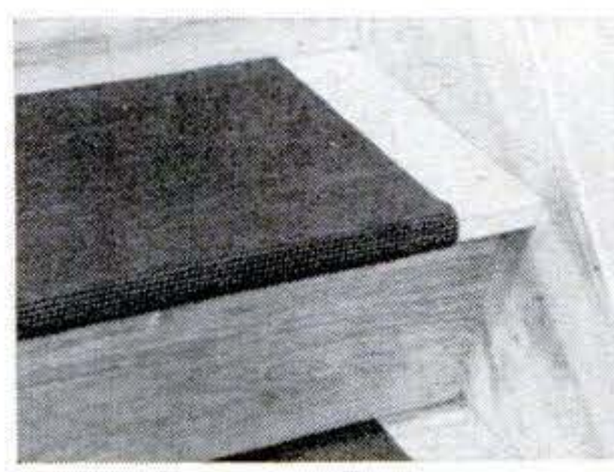


Mix Drinks, Not Glasses. A metal clip holding guest's initials or name to each glass will end confusion. Sold by Glasclips, Fullerton, Cal., for $1 a set.

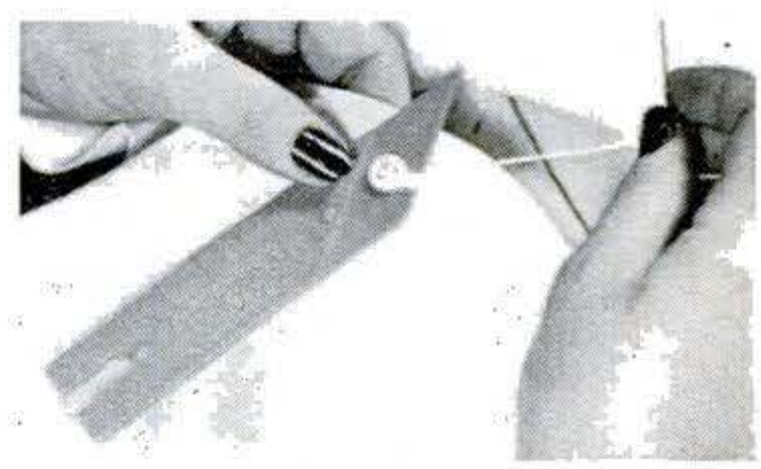


Picnic Table Is Portable. Folding this metal unit tucks the seats and legs inside. Handgrip can be used as umbrella holder. B. L. Brown, Orinda, Cal., makes it.

Dish Cools Butter. Saturate the porous clay top with cold water. Air currents will cause evaporation that keeps the butter cold and hard. The Norway Shop, Marion, Mass., $2.45.



Stair Treads. Molded to look like carpet, these rubber treads fool the eye. They're applied with linoleum paste. Artisan Galleries, Fort Dodge, Iowa, $1.10 each.



Sewing Aid. Use this gauge when sewing buttons, and the shanks will be evenly raised. It also removes basting threads, turns collar points, and is a 4″ rule. Sold by John Dritz & Sons, N. Y., for 19¢.

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HELICOPTERS: NOW

Eggbeaters Are Doughfoot's Friend-in-Need

By Capt. Hubard Kuokka, USMC

On the way to get a new gear assembly, the 'copter stopped to pick up a badly wounded Marine.

A MAN was crazy to fly a helicopter into such a deathtrap, but Marine Captain George Farish, of Hollis, N. Y., did it.

An infantry company of the First Marine Division was cut off by a horde of Chinese Communists in the snowy, biting-cold North Korean mountains, near Hagaru-ri. They were on their own. If they didn't get ammunition soon, there would be one less Marine rifle company in the morning.

So when Farish dropped down from the sky onto the little beleaguered pocket of Marines, he was a welcome visitor. He had barely settled his Sikorsky HO3S on the bloody snow before battle-stained hands eagerly started removing his load of ammunition, morphine, bandages, and rations. They were like kids grabbing for candy.

"Thanks, friend," a grimy-faced lieutenant shouted to Farish over the noise of the idling engine. "Just keep bringing us the ammo and we'll take care of the Commies."

A squall of Communist bullets splattered the aircraft. A Marine cursed a flesh wound on his arm. Somewhere back in the 'copter's engine compartment there was a crash. It sounded as if the 450-horsepower engine was munching on nuts and bolts. But the rotors were still turning. Farish climbed in. He knew he had to get the 'copter out of there fast.

A bullet crashed through the plastic cockpit behind his head. Another bullet buzzed past his nose as he pulled up on his collective pitch stick. He didn't wait for his rotor to turn up full r.p.m.

It was like trying to drive a stalled car off a railroad crossing in high gear with the Silver Meteor barreling down on you. But time and bullets were flying. The only way out was over the hill in front of him. The lumbering 'copter, tail-heavy and weak from insufficient r.p.m., bounced, rolled, and staggered up the slope amid a hail of excited steel. Finally it pushed over the brow like a man diving for a foxhole.

Over the top, Farish was able to build up his r.p.m. and flying speed. The clanking and rattling of the engine told him that a bullet had hit the gearbox, but he made the three miles to the newly built flight strip at Hagaru-ri. Even then he had reached no safe haven for repairing a broken-down helicopter. Night after night, the Chinese Communists had tried to wrest the airfield from the Marines. Their frozen bodies lined the runway.

As Farish assessed the damage, long-range bullets whistled out from the surrounding hills. Another helicopter was dispatched to get a new gear assembly from a rear base.

Two days later Farish's "Gooney Bird" was ready for another routine mission.

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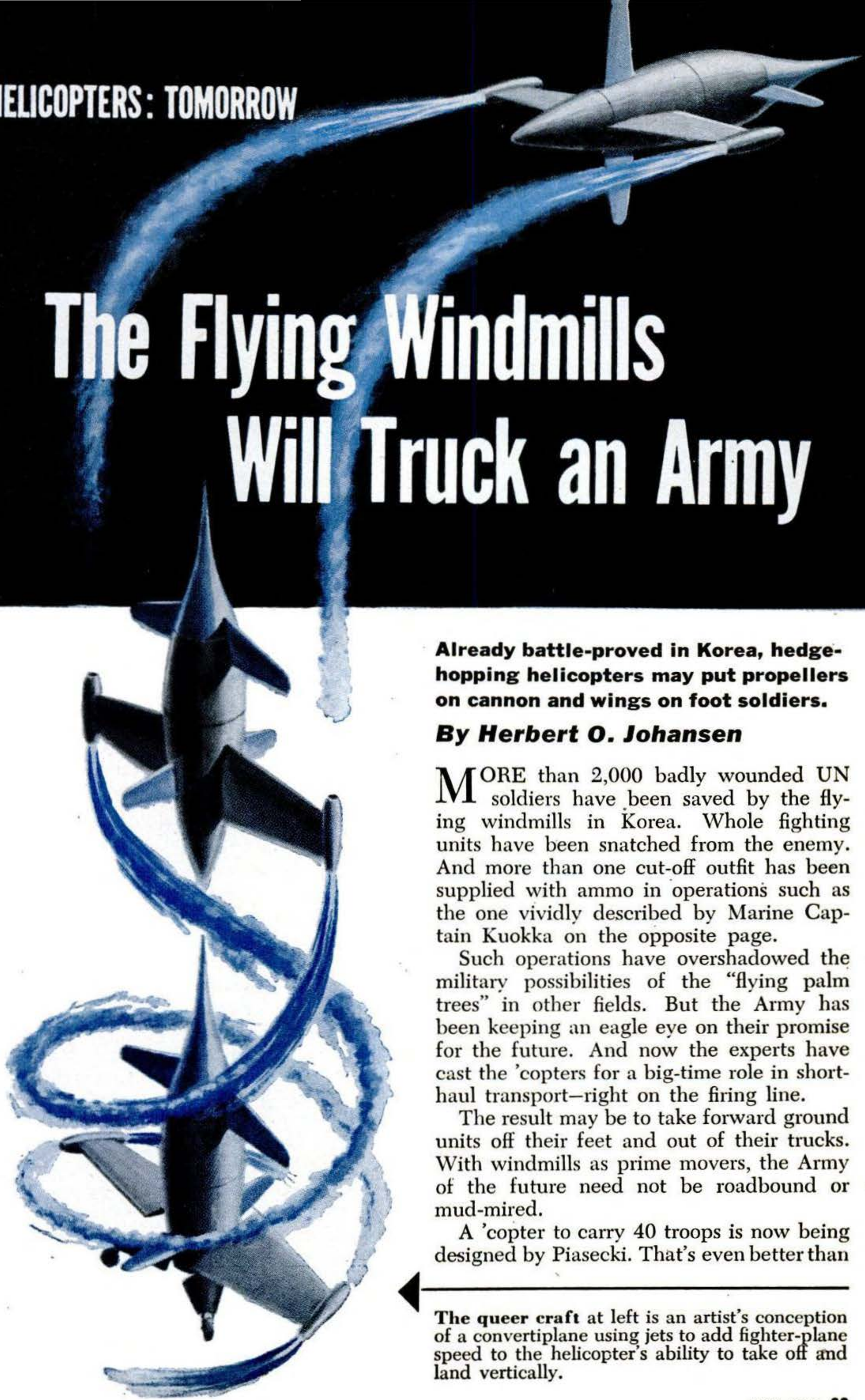
HELICOPTERS: TOMORROW

The Flying Windmills Will Truck an Army



Already battle-proved in Korea, hedge-hopping helicopters may put propellers on cannon and wings on foot soldiers.

By Herbert O. Johansen

MORE than 2,000 badly wounded UN soldiers have been saved by the flying windmills in Korea. Whole fighting units have been snatched from the enemy. And more than one cut-off outfit has been supplied with ammo in operations such as the one vividly described by Marine Captain Kuokka on the opposite page.

Such operations have overshadowed the military possibilities of the "flying palm trees" in other fields. But the Army has been keeping an eagle eye on their promise for the future. And now the experts have cast the 'copters for a big-time role in short-haul transport—right on the firing line.

The result may be to take forward ground units off their feet and out of their trucks. With windmills as prime movers, the Army of the future need not be roadbound or mud-mired.

A 'copter to carry 40 troops is now being designed by Piasecki. That's even better than

The queer craft at left is an artist's conception of a convertiplane using jets to add fighter-plane speed to the helicopter's ability to take off and land vertically.

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TODAY The egg beater hovering above a roadbound supply column, held up by a traffic snafu in Korea, dramatically illustrates why the Army wants helicopters.

a recent demand by General Clifton Cates, Commandant of the Marine Corps: "The Marine Corps must receive huge assault helicopters, each capable of landing about 35 men and their equipment quickly on the beaches in any future war."

But Igor Sikorsky, daddy of the helicopter, states that models carrying 125 persons at 125 m.p.h. are practical at present —with speeds of 500 m.p.h. plausible.

A "Flying Crane" helicopter is being developed by the Hughes Aircraft Co. This XH-17 giant could carry entire bridge sections across mountains and then set them in place over a river. And while the bridge was being built, other Flying Cranes could be air-ferrying tanks and heavy artillery to carry on the advance without delay.

Farther away, but in the works, is the convertiplane—the helicopter that gets high speed in forward flight by making like an airplane. This hybrid helicopter, because of its ability to take off and land vertically, may eliminate the need for long runways and even for specialized aircraft carriers.

The unique virtue of the helicopter is its ability to maneuver in and out of small areas. It can land in a place instead of a space; an air patch becomes an airbase. But while the speed predicted by Sikorsky probably will have to wait for the convertiplane, the Army seems to be satisfied with what present 'copter speeds can do for its transport.

Anything a Mule Can Do

Army transport gained speed when it changed the fuel for its vehicle power from oats to gasoline about 20 years ago. But it was—and still is—roadbound. Roads have to be built or kept in condition. Rivers have to be bridged by materials hauled over roads or crossed in cumbersome boats brought up the same way. And a lot of the toughest fighting has been in jagged-peaked mountains where roads don't grow and can't be built. Then the doughfoot really had it. He prayed for mules until he saw the helicopter, which can do anything a mule can do—and fly, too.

Evidently the brass agreed with him, for the Army recently announced that it is organizing helicopter transport companies to speed up the movement of infantry units. Each company has 21 flying "trucks," and two small flying "jeeps" for reconnaissance and liaison missions. In one lift, a single windmill unit can air-haul the combat troops and equipment of an entire rifle company.

On the road, an infantry company can make a motorized march of about 150 miles a day at an average speed of 15 m.p.h.

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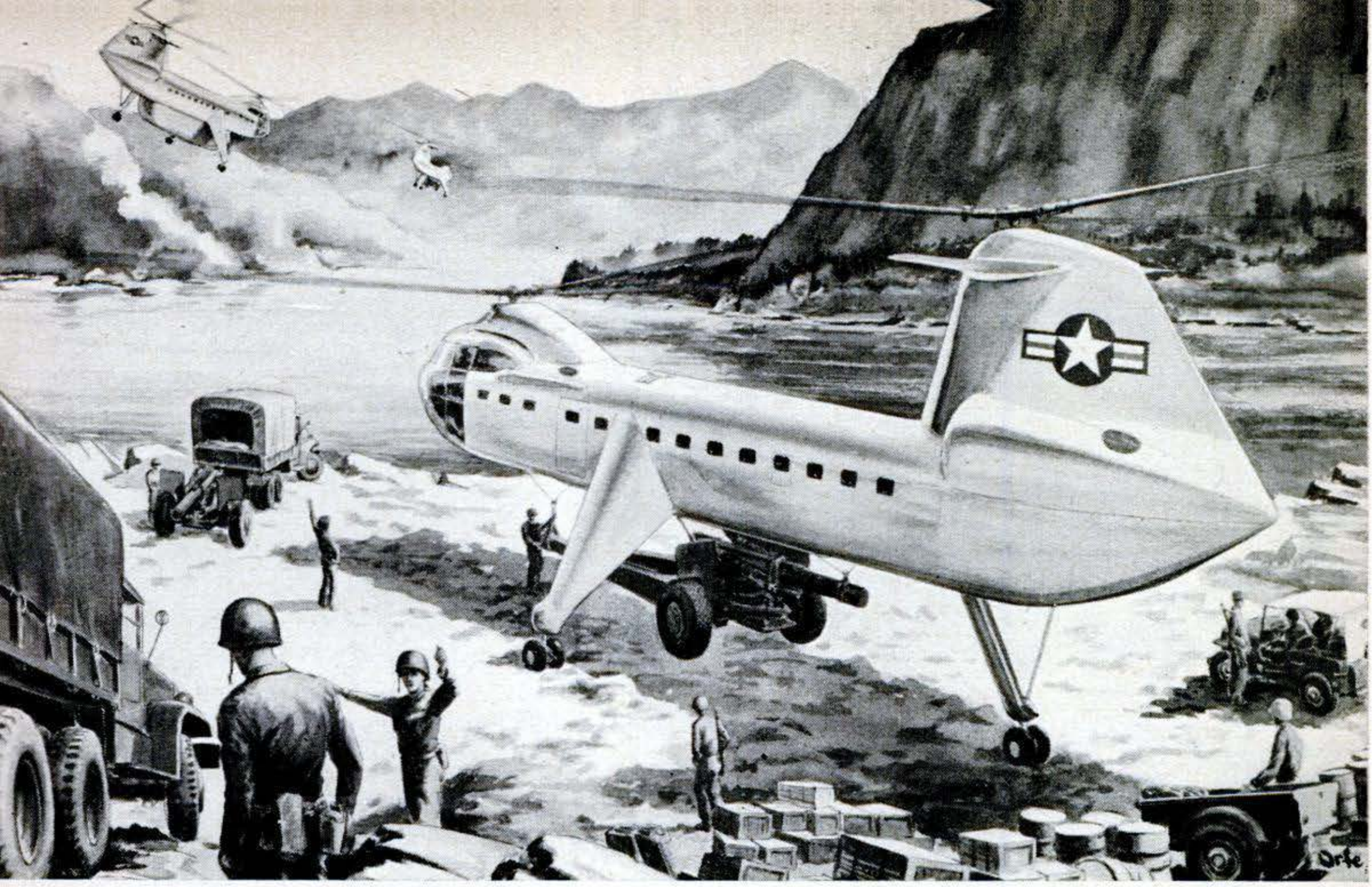

TOMORROW Rivers or mountains would be no barrier to infantry using this giant helicopter truck, shown air-lifting a 155-mm. howitzer.

Through the air, the day's march will be stepped up to 600 miles, at an average speed of 60 m.p.h.

The significance of this increased speed in combat is not in the point-to-point distance that can be covered, but in the number of short-haul hops that can be made. Where a truck makes one round trip, the 'copter can make three or four. And in the type of terrain battled through in North Korea, that ratio often would be changed to four to none—because the truck wouldn't be able to make it at all.

That's where the greater speed of the airplane can't compete with the windmill's ability to take off from and land in almost any clearing. Neither mountains, nor water, nor jungle in between matter to either. But the airplane needs airfields: long runways, navigation aids, lighting—all rarely available in forward combat areas.

The egg beaters sneer at such ground coddling. Being able to fly slowly, helicopters can fly low in weather that would send the pilot of an airplane screaming for every electronic navigation aid in the books —or crashing into a mountain. Meeting that mountain, the 'copter pilot just backs off and hops over, thank you. And in landing, he can grope his way in—with any faggot torch making a sufficient X to mark the spot where he'll leisurely settle down like a hen on her nest.

It Dodges in All Directions

A slowpoke as aircraft go, yet the helicopter is no sitting duck when the shooting starts. What it lacks in speed it makes up for in evasive aerial maneuvers: going up and down like a jack-in-the-box, reversing direction like a shuttlecock, or sideflying in a swing-and-sway routine. Even when hit in the vital rotor region, the 'copter has proved in Korea that it can keep whirling away until mission is completed.

In mountain warfare the helicopter may reach its peak—of performance. Today that kind of fighting is a job for a few trained specialists. All supplies have to be back- or mule-packed or pulled on sleds. Air drops of supplies, missing their target by only a short distance, may be lost forever in a crevasse or on an avalanche slope. But the windmills will make it possible for any combat soldiers to descend on cloud-draped peaks and seize fortified enemy aeries.

With a helicopter ship-to-shore pick-up service, equipment and spare parts could be flown directly to the front line from floating supply depots on old Liberty ships moving along coastal areas or up navigable rivers.

And as the amphibious vehicle came out

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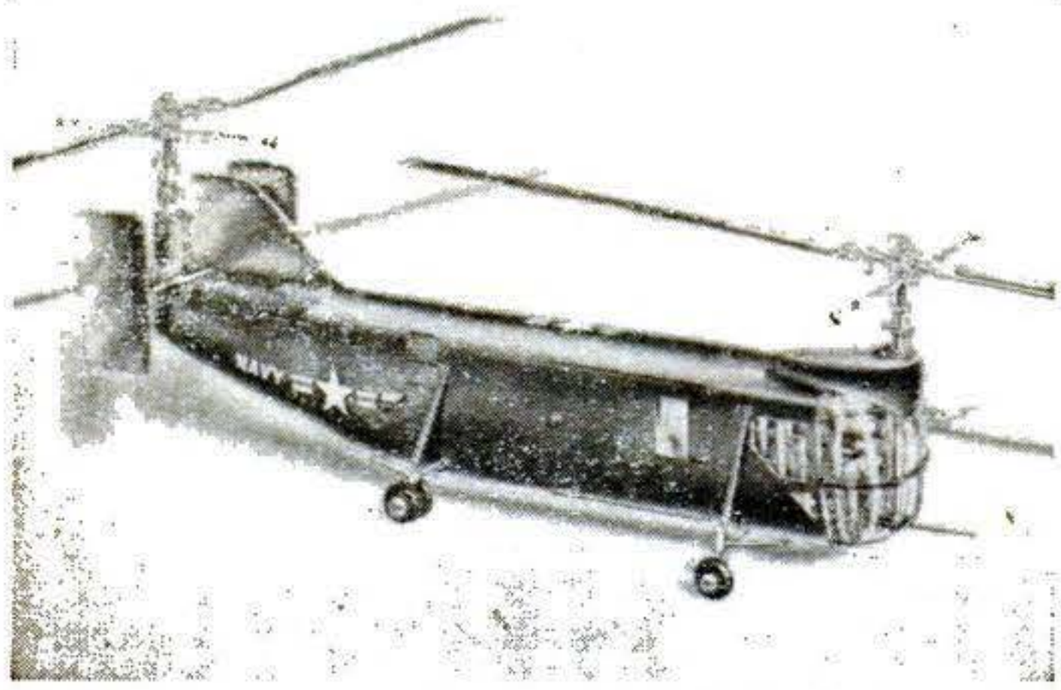
Sikorsky flying jeeps were the helicopter pioneers on the Korean battlefront. This new, four-place H-18 can carry approximately 800 pounds at a top speed of about 105 m.p.h.



Artist's drawing shows sub-killing 'copter designed by Bell for Navy. It can lower big ears and listen for enemy subs lurking too far under the water to be spotted from the air.

Sleek lines have been added to the helicopter in this new model designed by D. K. Jovanovich for McCulloch Motors, of Los Angeles. The maker claims absence of vibration, simple control.

of World War II, so an "airphibian" helicopter may come out of our Korean experience. A fixed-wing airphibian craft has been developed for commercial use. Adapting the same principles to the windmills, it would enable a "jeep" or "truck" to travel over a road, hop over any obstacle, and continue its road trip on the other side.

But the convertible 'copter of the future is a bird of a different feather—the convertiplane. It is a craft that rises vertically from the ground as a helicopter and then flies level in forward flight as a fixed-wing aircraft. Object: greater speed.

Top speed of present helicopters is about 130 m.p.h. It has been suggested that adding a small fixed wing to a helicopter might raise its speed to 250 m.p.h. But that doesn't satisfy the convertiplane designers.

How will the convertiplane convert in mid-air from one type of flight to another? Here are three ways it may be done after the craft has risen vertically as a helicopter:

- Heel over in mid-air and fly level, using its rotors as propellers.
- Pivot its rotors after take-off, from horizontal to vertical so they become props.
- Fold up its rotors and let separate propellers take over forward flight.

And, of course, there is jet propulsion in the convertiplane's future. The technical problems to be solved are many and complex. But in aviation the impossible always comes to pass.

Next Month: POPULAR SCIENCE will bring you the story of the boy wonder who grew the Flying Bananas.

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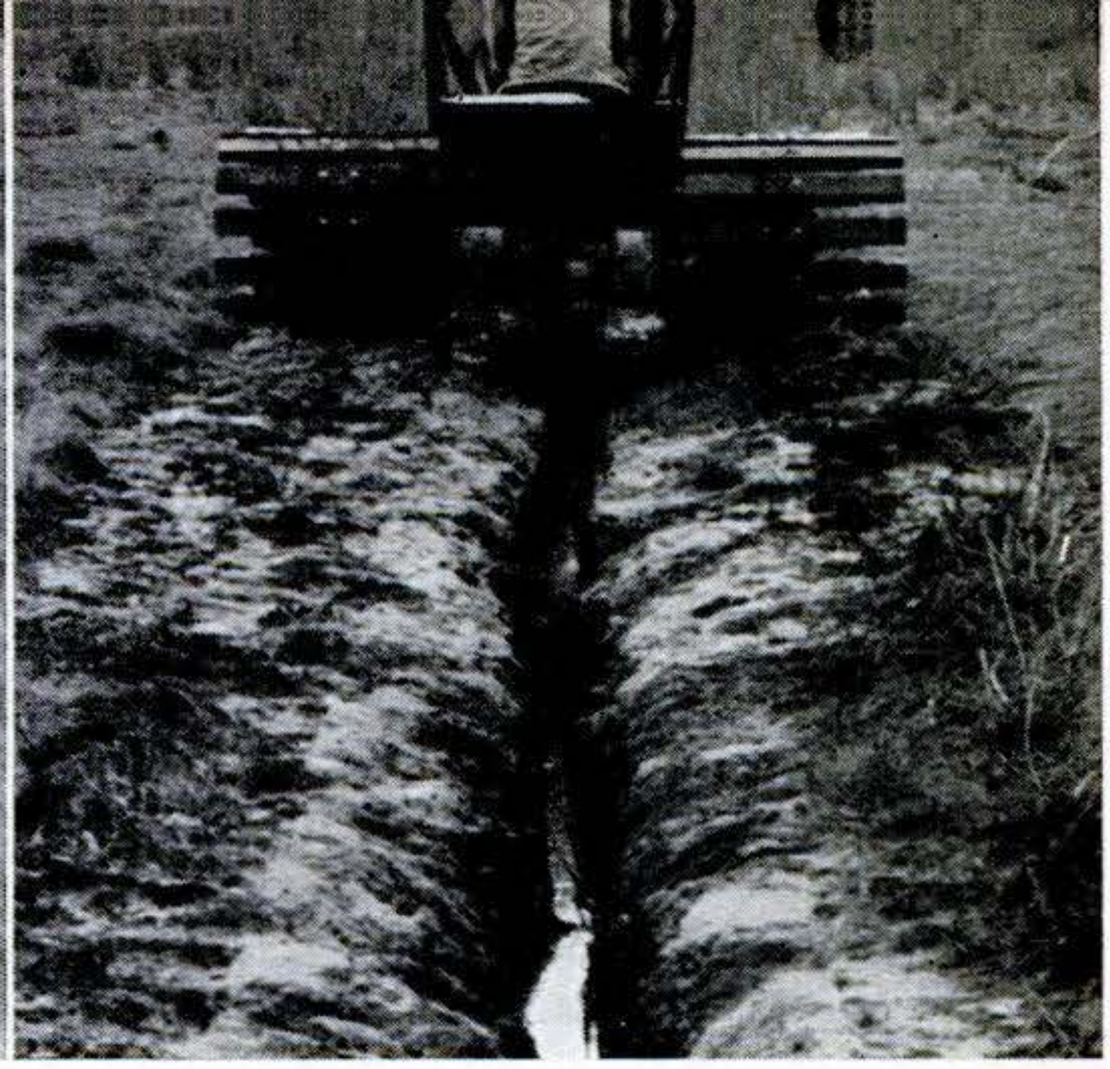
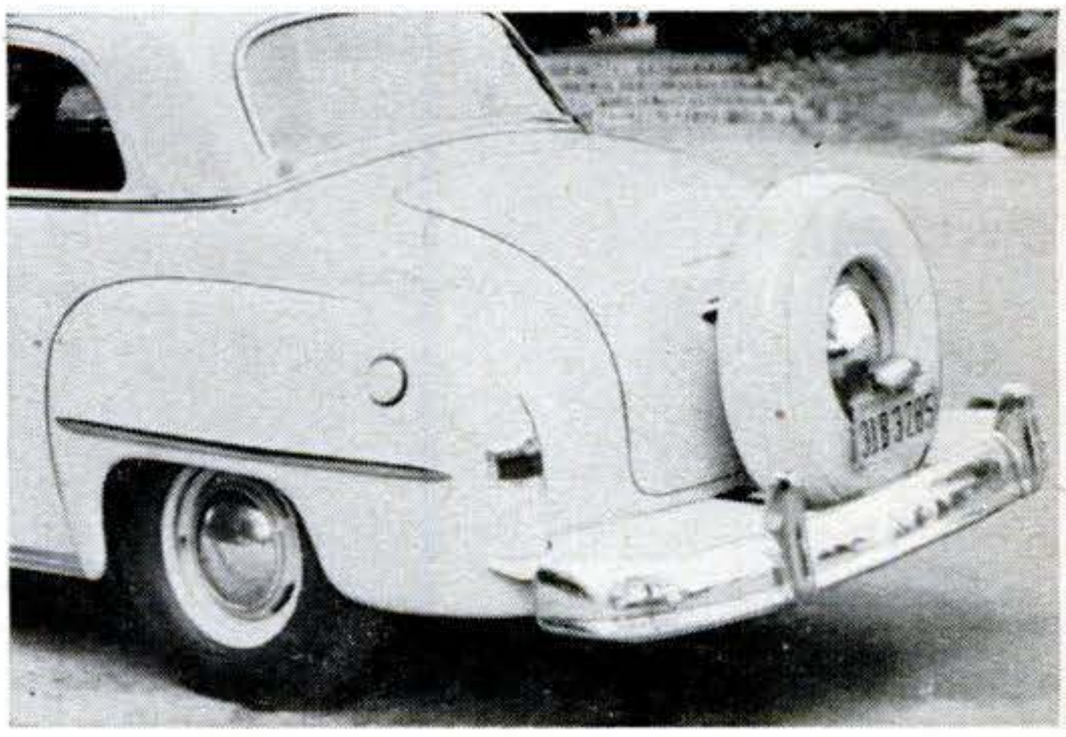


Ditch Cleaner Discourages Skeeters

MOSQUITO control requires drainage of marshlands. The problem of keeping the ditches open is solved by the ditch cleaner shown above in before and after views. It consists of a plowlike attachment to the loading arms of a caterpillar tractor. Mud and grass scooped out from a ditch is fanned out on the banks and crushed by wooden cleats fixed to the tractor treads. In five minutes the machine does a day's work of five men. It was developed by R. C. Botsford, retired chief of Connecticut's mosquito-control program.

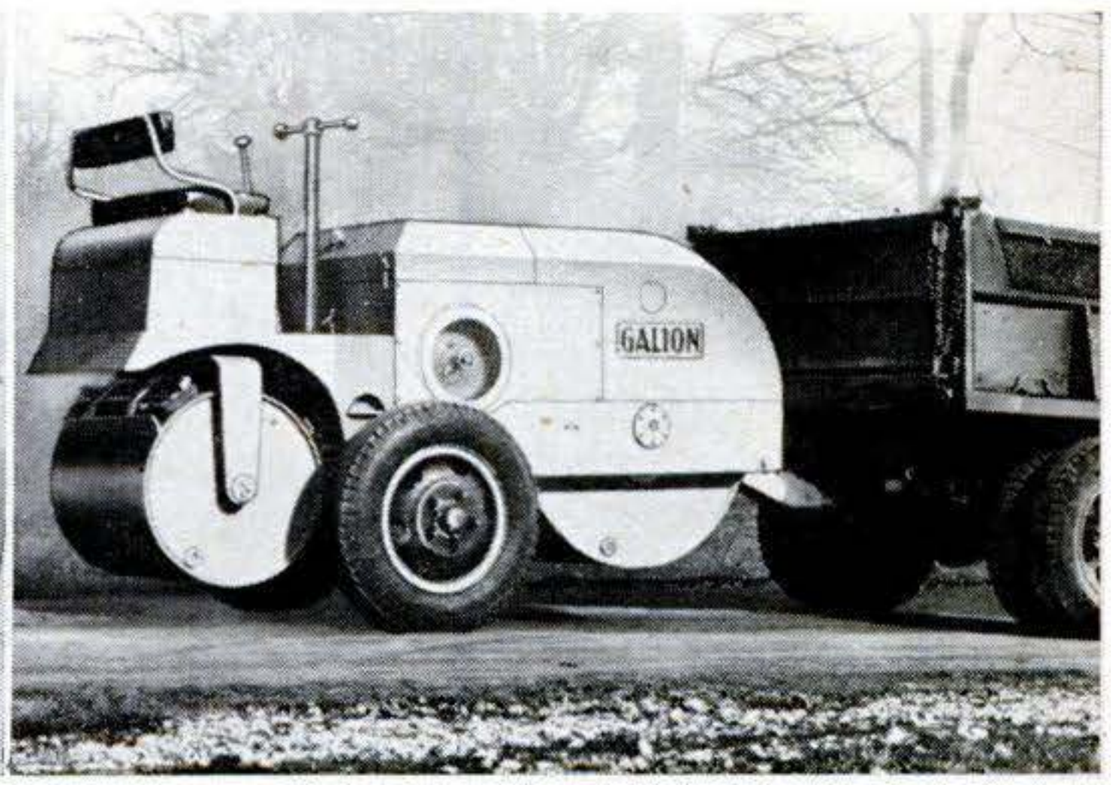
The Spare Comes Back Outside

DON'T look now, but that spare and wheel are right back where they started from—attached to the outside of the car. Pulling the spare out into the open increases level luggage space as much as 25 percent. It's also swanky. The bracket is hinged to give access to the trunk and locks to the trunk lid. This "Continental" conversion assembly is made for Fords, Chevrolets, and Kaisers by the Hudelson-Whitebone Corp., of Champaign, Ill.



Roller Rides to the Job on Rubber

HEAVY road rollers now can ride from one job to another quickly and in trailer-style ease. The roller is backed up ramp blocks and pneumatic-tired wheels with stub axles are attached, as at left below. Then the tongue of a towing hitch is hooked to a truck, the front end of the trailer is raised off the ground by a hand-operated hydraulic jack, and it's ready to roll. The attachment is made by the Galion Iron Works and Mfg. Co., of Galion, Ohio.



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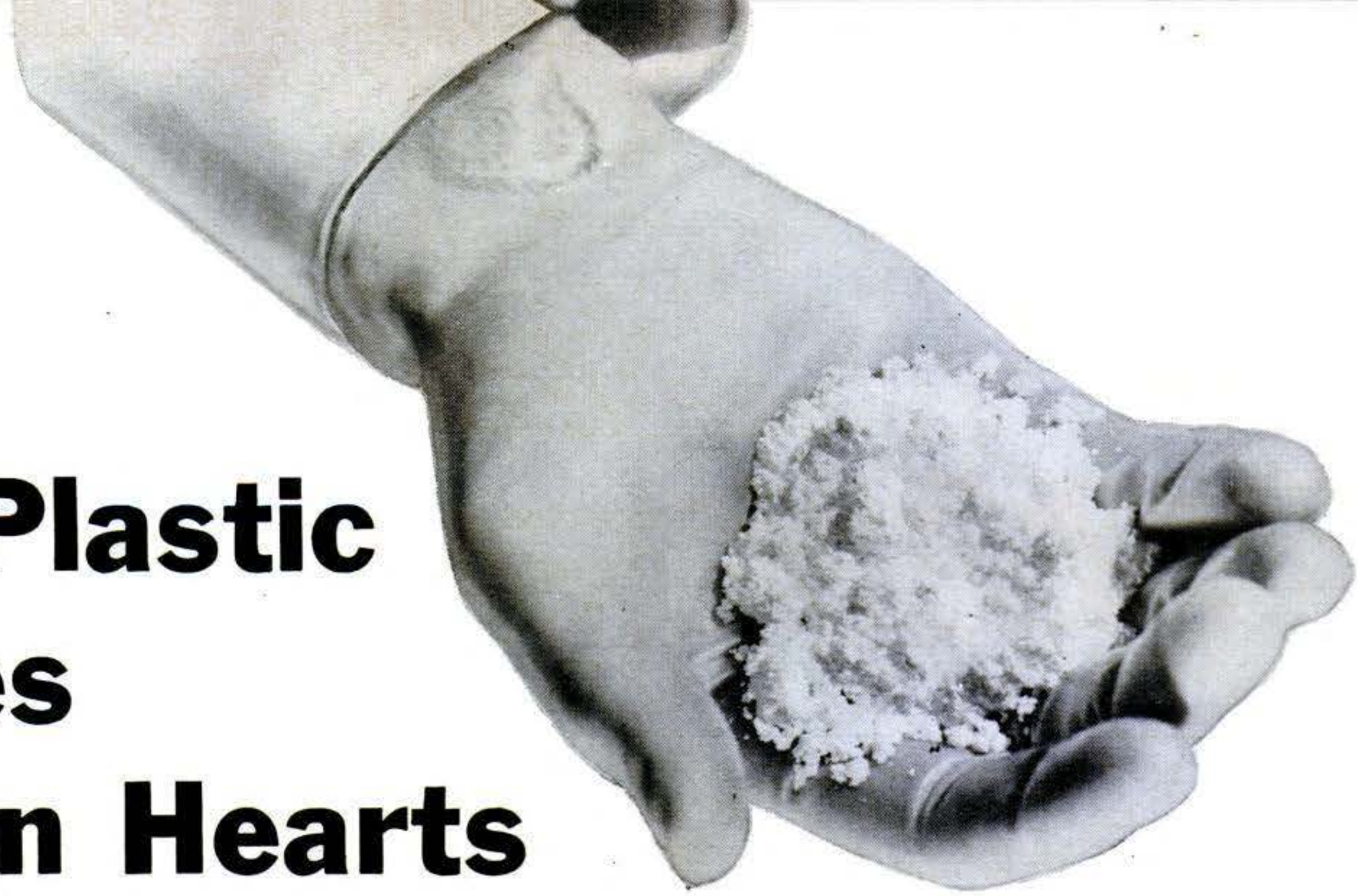

New Plastic Primes Human Hearts

PVP, a nonperishable factory-made substitute for blood plasma, can keep spark of life glowing in persons suffering severe shock.

By Lloyd Stouffer

IN PHILADELPHIA General Hospital I watched the golden fluid trickle from a transfusion bottle into the arm of a patient who lay deathly still. A 50-year-old woman, weakened by internal bleeding, had been brought in in a state of total collapse, with no discernible pulse or blood pressure. As the fluid surged through her veins she stirred and opened her eyes. After 45 minutes and about two quarts of fluid, her blood pressure was close to normal, and she sat up and talked cheerfully with the doctors.

> THE development of PVP and other plasma substitutes is an important step in preparing this country for an emergency. But it must not be misunderstood. Plasma is only the first step in saving lives. Korea has demonstrated over and over again that wounded men suffering great blood loss can be saved only if there are large amounts of *whole blood* available. It is therefore vitally important—more so now than ever—that blood donations *be constantly increased.* This is one program that must not fail.
>
> —ROSS T MCINTIRE, Vice Admiral (M.C.), USN, Ret'd., National Blood Program, American National Red Cross

Outwardly there was nothing unusual about this restoration to life. It happens almost every day on the battlefield and in hospitals where human blood is available.

But the substance that primed this woman's heart came from no human veins. It was a plastic, straight out of a factory—a plastic closely akin to the stuff that makes the shower curtain in your bathroom.

This remarkable medical plastic is polyvinyl pyrrolidone, known as PVP. Made from acetylene (the gas that lit the headlights of automobiles a generation ago), it is cheap to manufacture; it can be stored indefinitely and is unaffected by extremes of heat or cold; and its supply, unlike plasma, is virtually unlimited.

First Used in Europe

In Germany, where PVP was developed, the plastic plasma is credited with saving the lives of tens of thousands of German soldiers during the last war. It has been successfully administered to nearly a million persons in Europe. Now it has been brought to this country, further improved by American scientists, and exhaustively tested by the National Research Council, which has the urgent responsibility of finding an acceptable substitute for plasma, capable of being stockpiled for defense needs.

Blood plasma, the clear portion of human

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Solution of PVP—shown in powder form on the opposite page—here trickles from transfusion bottle into a vein in the arm of a patient in Philadelphia General Hospital.

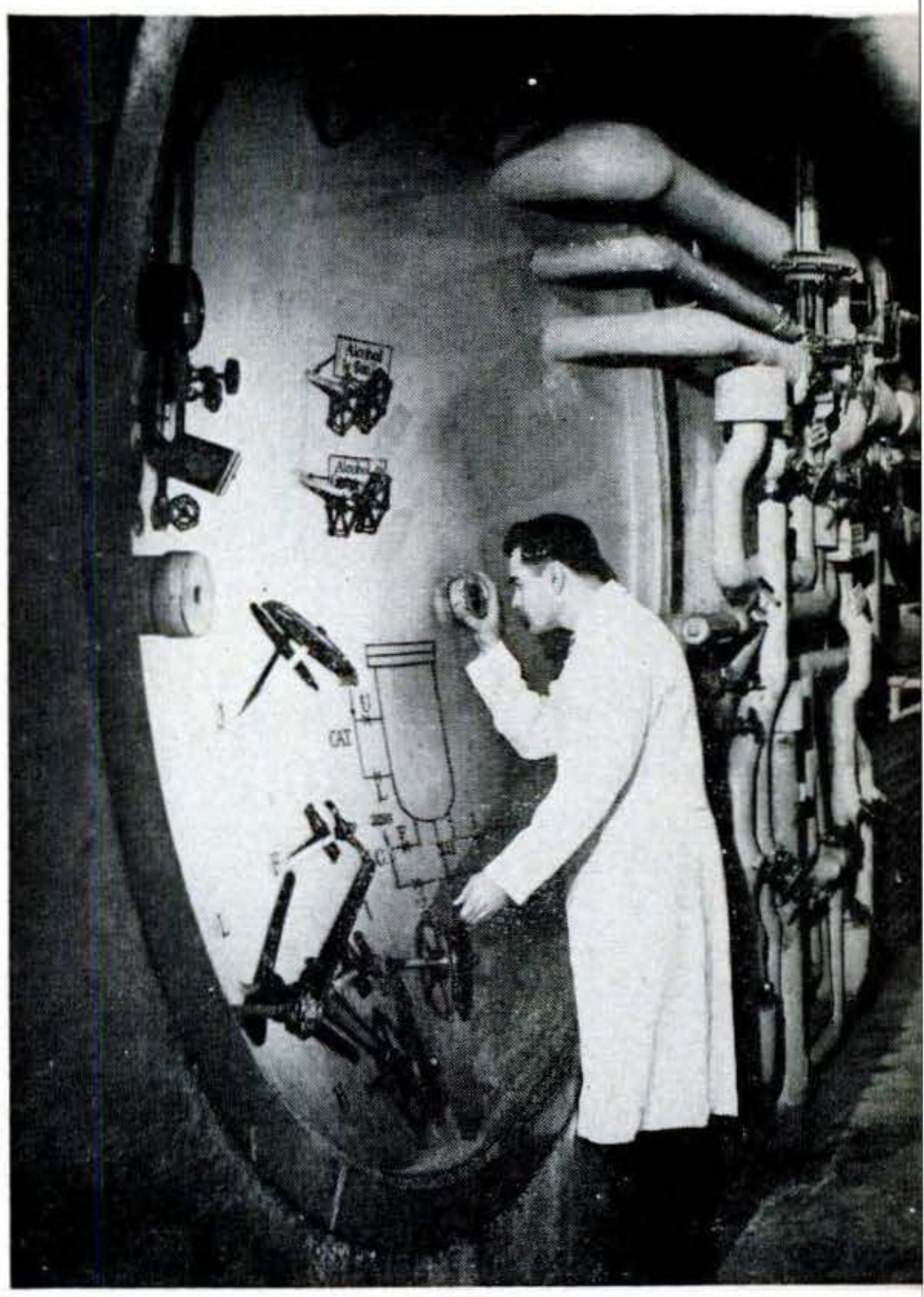
blood without the living red and white cells, is the ideal remedy for shock. Plasma restores the circulation and keeps it going until a blood transfusion or other treatment can be given. In normal times there is enough real plasma to meet our needs. But today the United States, with its crowded cities, is a potential target for atom bombs.

Stockpile Needed in an Emergency

Doctors know from Hiroshima and Nagasaki that atom-bomb injuries frequently result in shock. In the event of a surprise raid, thousands of Americans might die needlessly unless quick treatment could be supplied. This means that plasma must be available in ample quantities wherever an emergency might occur.

To protect itself against the atomic threat, authorities estimate that the United States should have an *immediate* stockpile of 10 to 15 million pints of plasma or plasma substitute. Even this staggering figure does not include the amounts needed routinely by the armed forces, which are figured at one pint per year for every man. Obviously no such quantity of real plasma could be obtained quickly. It takes nearly two and a half pints of blood to get a pint of plasma. And during the entire five years of World War II, Americans contributed 13,326,242

[*Continued on page 208*]



PVP is synthesized under high pressure in new plant of General Aniline & Film Corp. at Grasselli, N. J. Process is regulated by remote control from this explosion-proof corridor.

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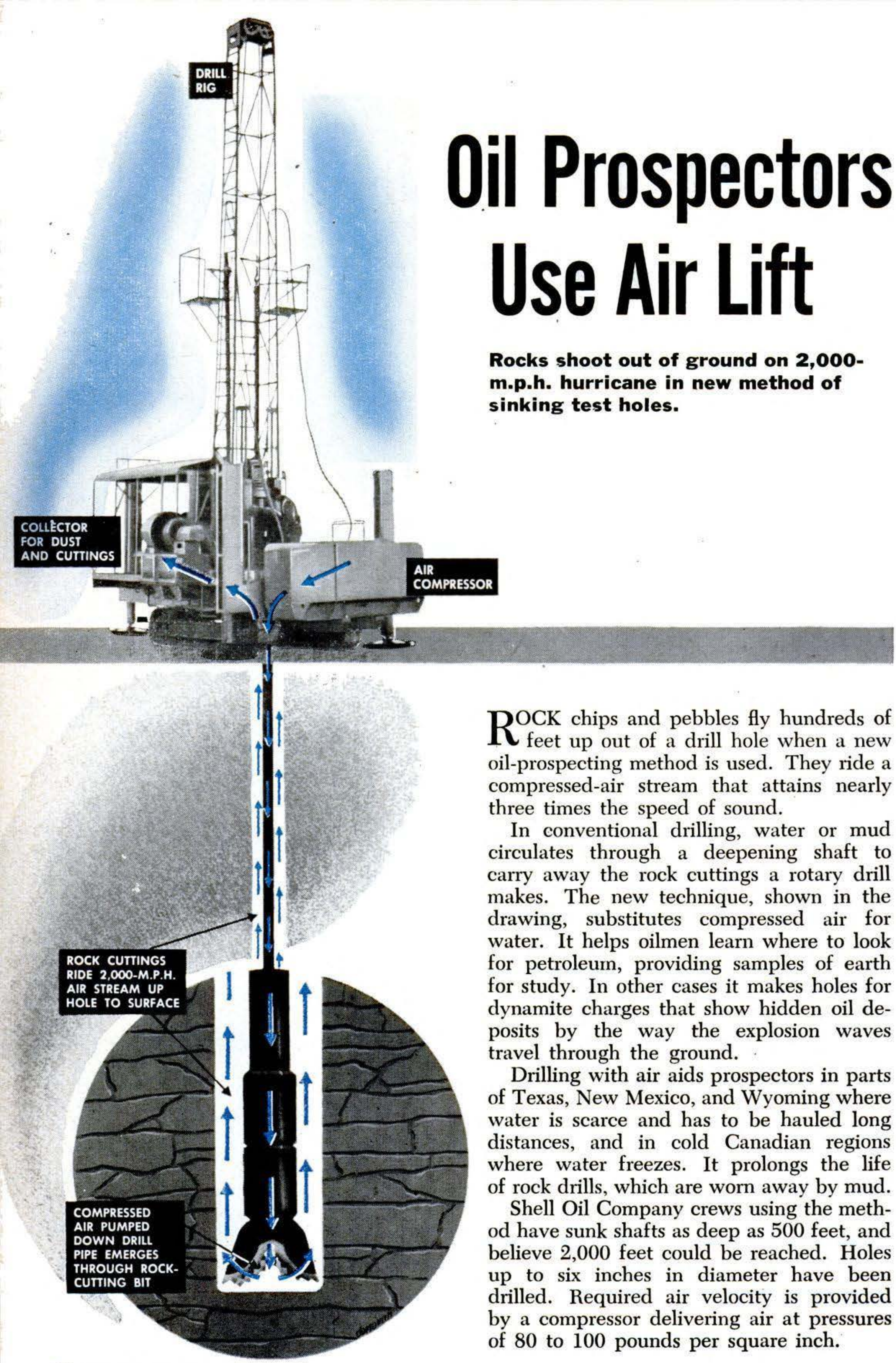

Oil Prospectors Use Air Lift

Rocks shoot out of ground on 2,000-m.p.h. hurricane in new method of sinking test holes.

ROCK chips and pebbles fly hundreds of feet up out of a drill hole when a new oil-prospecting method is used. They ride a compressed-air stream that attains nearly three times the speed of sound.

In conventional drilling, water or mud circulates through a deepening shaft to carry away the rock cuttings a rotary drill makes. The new technique, shown in the drawing, substitutes compressed air for water. It helps oilmen learn where to look for petroleum, providing samples of earth for study. In other cases it makes holes for dynamite charges that show hidden oil deposits by the way the explosion waves travel through the ground.

Drilling with air aids prospectors in parts of Texas, New Mexico, and Wyoming where water is scarce and has to be hauled long distances, and in cold Canadian regions where water freezes. It prolongs the life of rock drills, which are worn away by mud.

Shell Oil Company crews using the method have sunk shafts as deep as 500 feet, and believe 2,000 feet could be reached. Holes up to six inches in diameter have been drilled. Required air velocity is provided by a compressor delivering air at pressures of 80 to 100 pounds per square inch.

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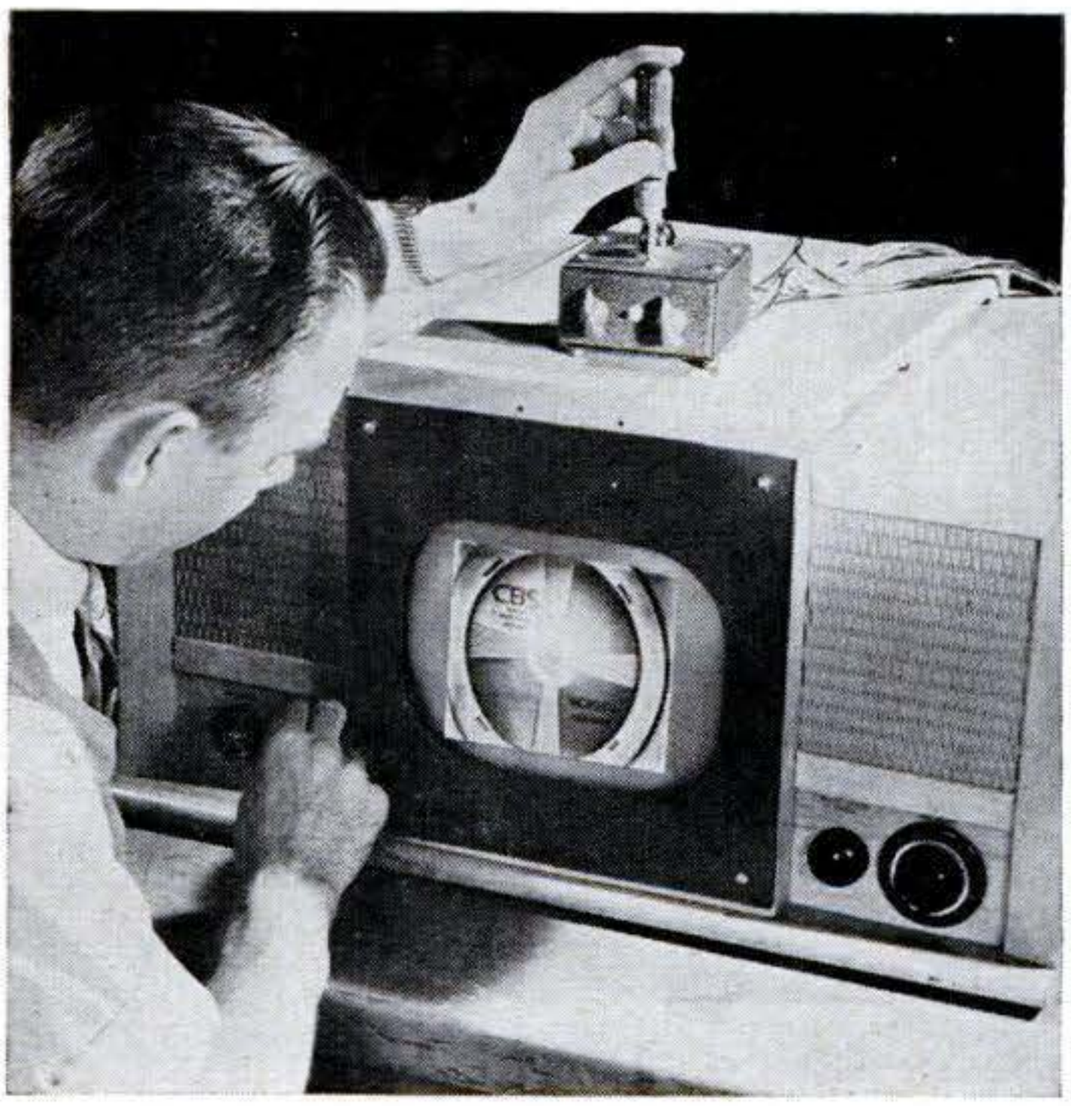
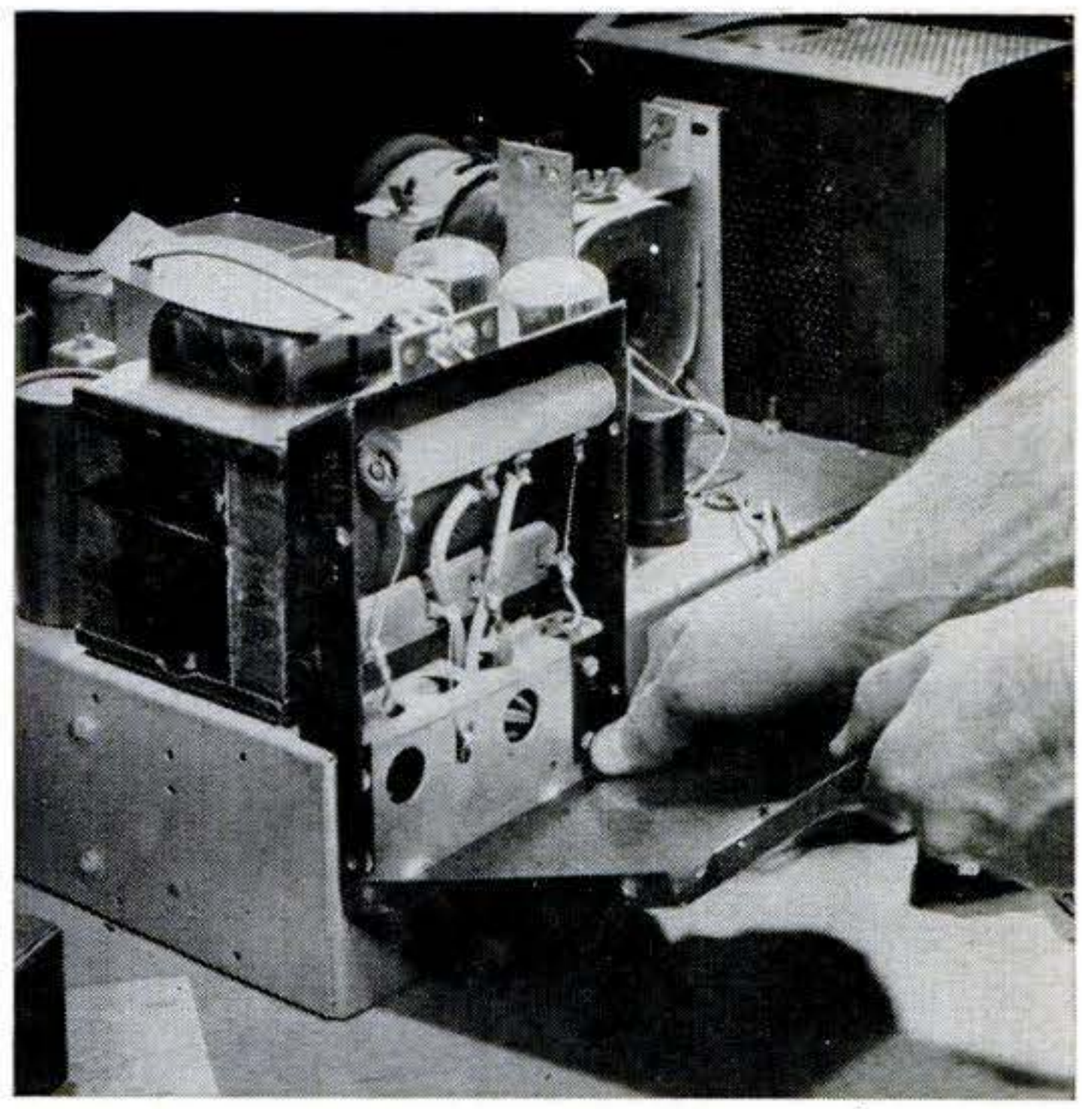




A black metal plate at the left rear of the 630 chassis covers a large resistor and two ¾" holes. All leads from adapter can be fed to the chassis through the left-hand hole.

My TV Set 'Sees' Color Pictures

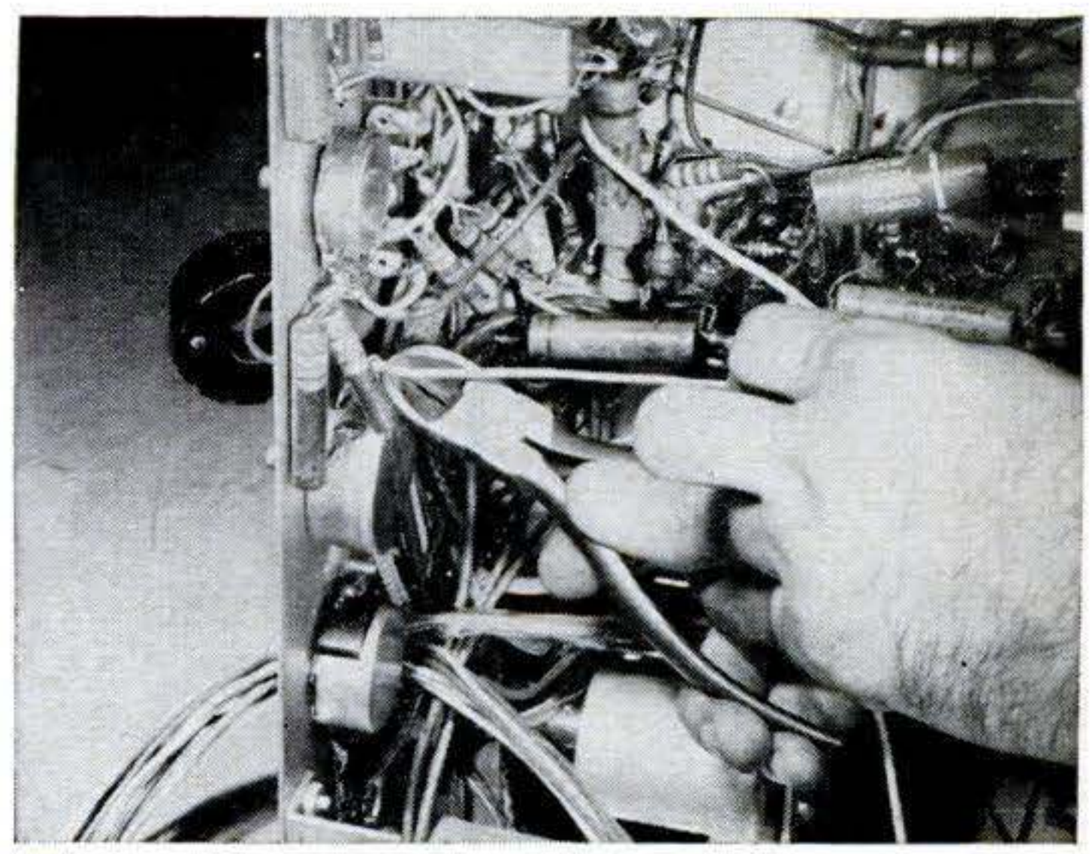
This $4 adapter made a dual-purpose televiser out of a 630-type receiver. Here's how I built and wired it.

THOSE streaks and bars you may have seen on your screen lately are color television. They don't look like much on present sets, but with a few dollars' worth of parts you can turn them into good black-and-white images. I recently did just that on a set using the popular, widely licensed RCA 630 circuit. It doesn't hurt the set a bit—a flip of a switch and I'm back to regular reception. And later on I can simply add a motor-driven color wheel and get the pictures in full color.

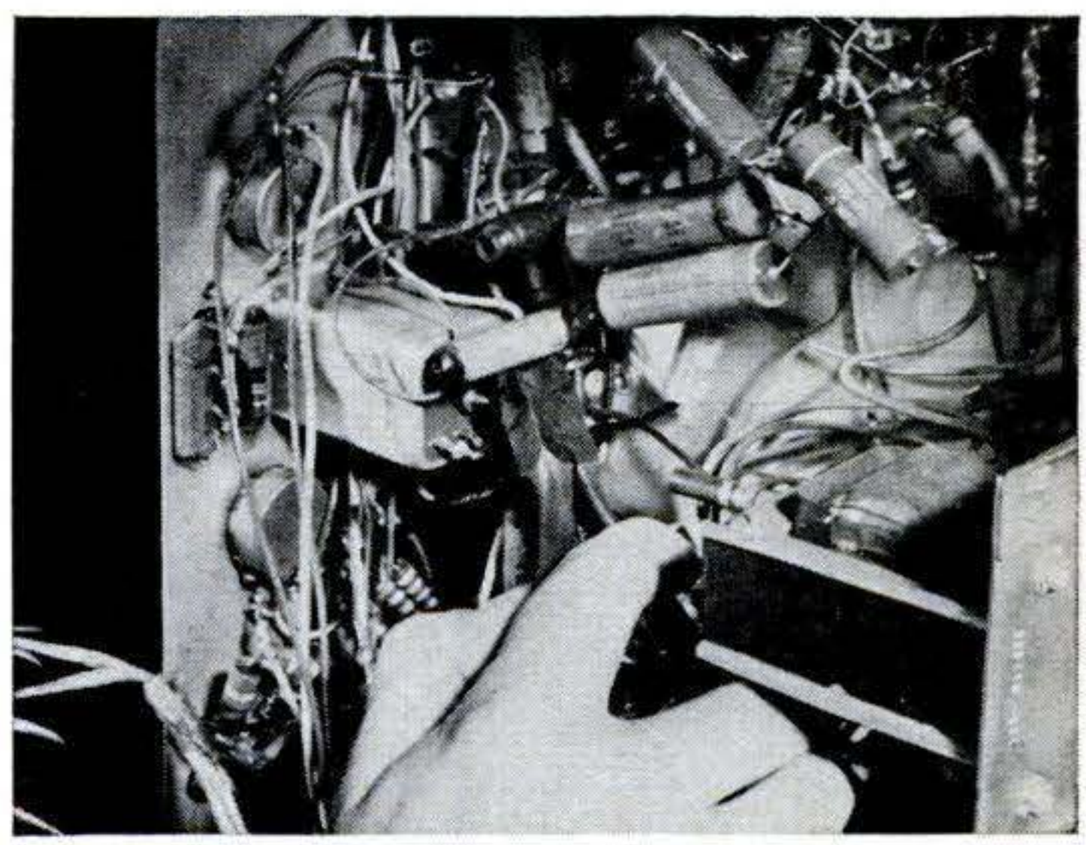
The fast-moving electron beam that paints a TV picture is guided by two oscillator circuits that whip it back and forth and up and down the tube face. To adapt a set you have to increase the speed of both the horizontal and vertical oscillators.

In a 630-type receiver this means changing three condensers. For convenience in adjusting the color picture, it is also desirable to add new controls for color focus, height, and vertical linearity. All the circuit changes —and the parts I used—are shown on the next two pages.

It is almost impossible to find condensers of exactly the right capacity, so I used an



Three connections to rear-apron controls have to be cut so new leads can be installed. I cut the wires right at the control terminals.



Three condensers have to be removed. They can be used in the adapter box. In some 630 models, four condensers are affected.

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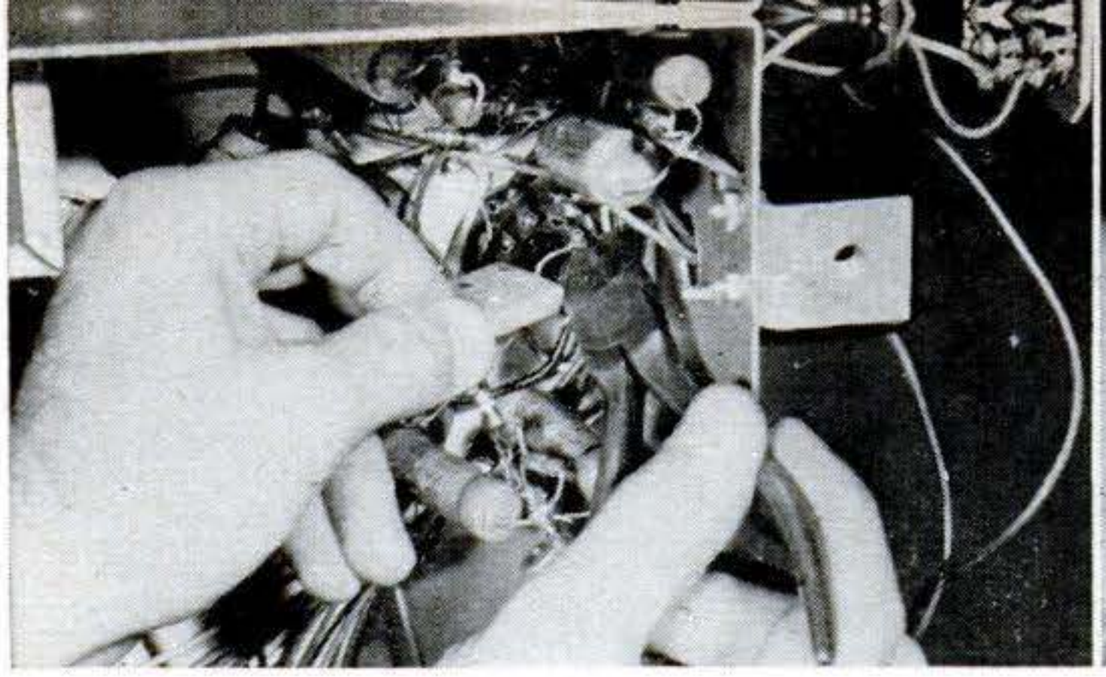
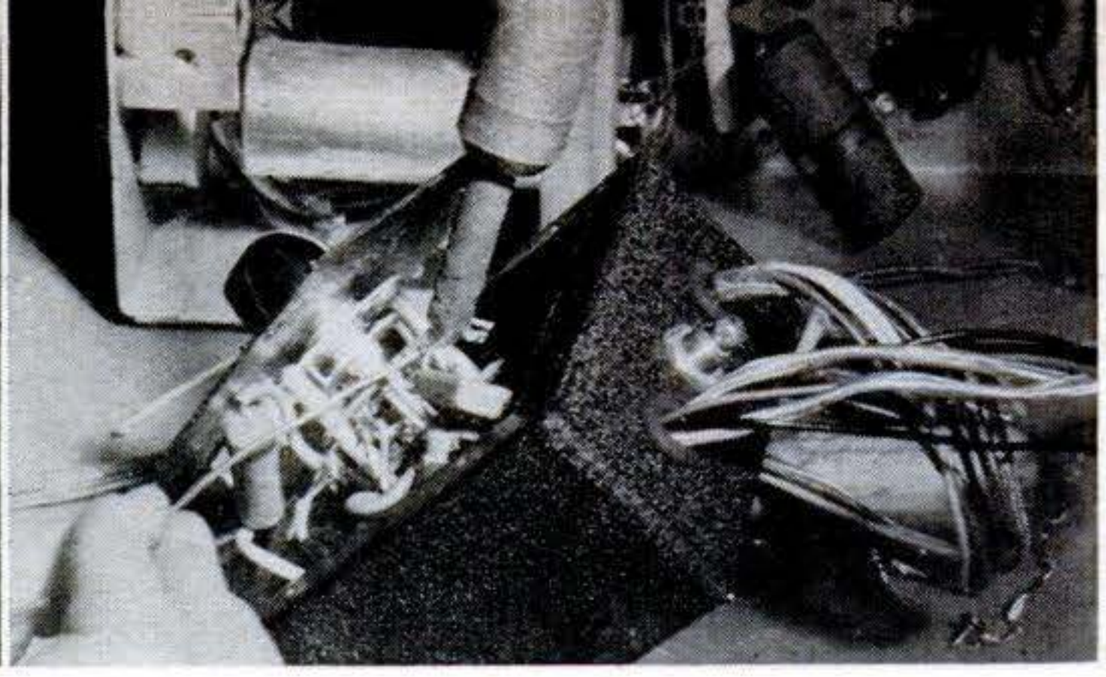




This 4,700-mmf. mica condenser is taken out of the vertical oscillator circuit—(left, above) and installed in adapter box (right) between shielded lead *d* and switch contact 10.

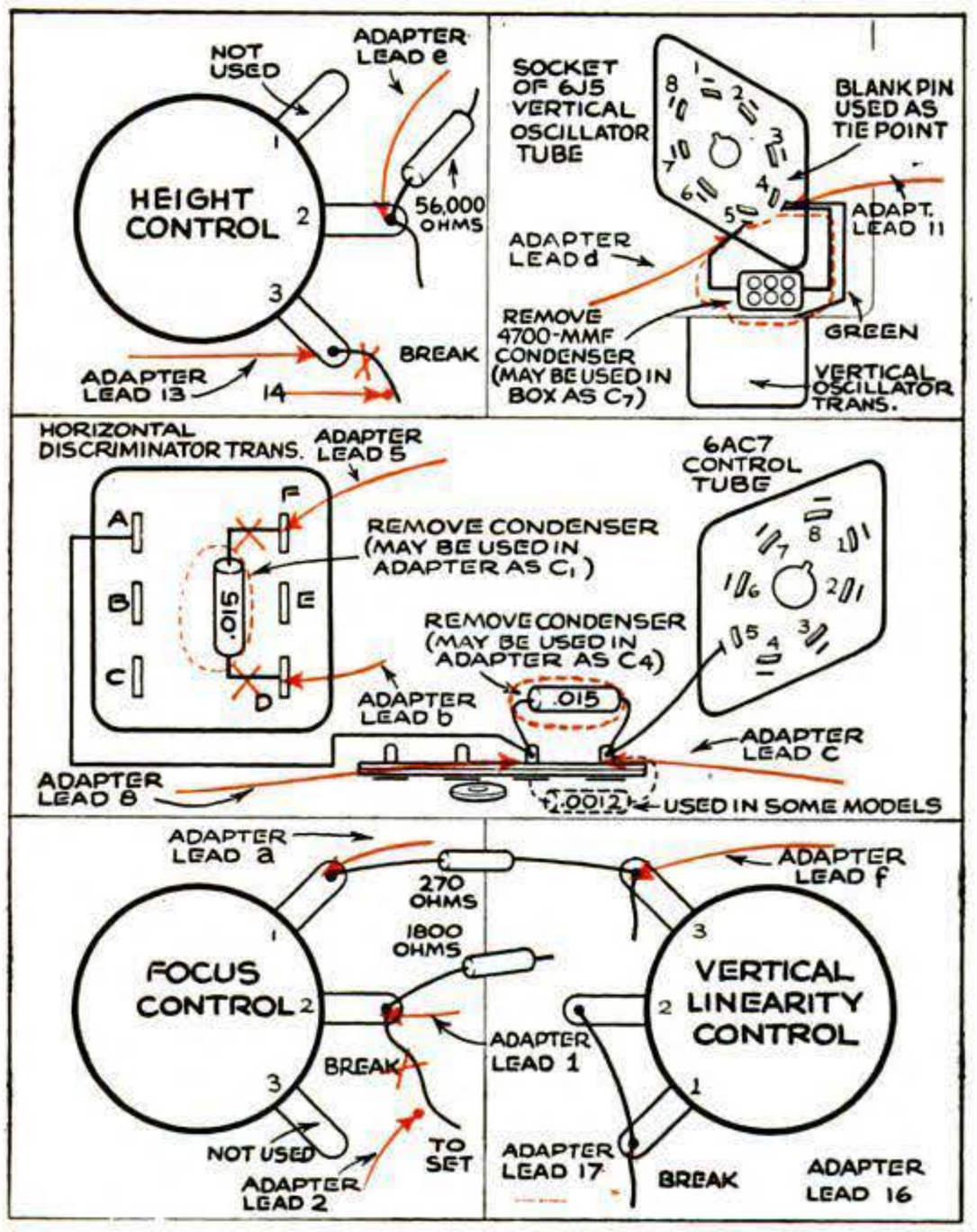
adjustable trimmer and a fixed capacitor in parallel in three of the circuits that I altered.

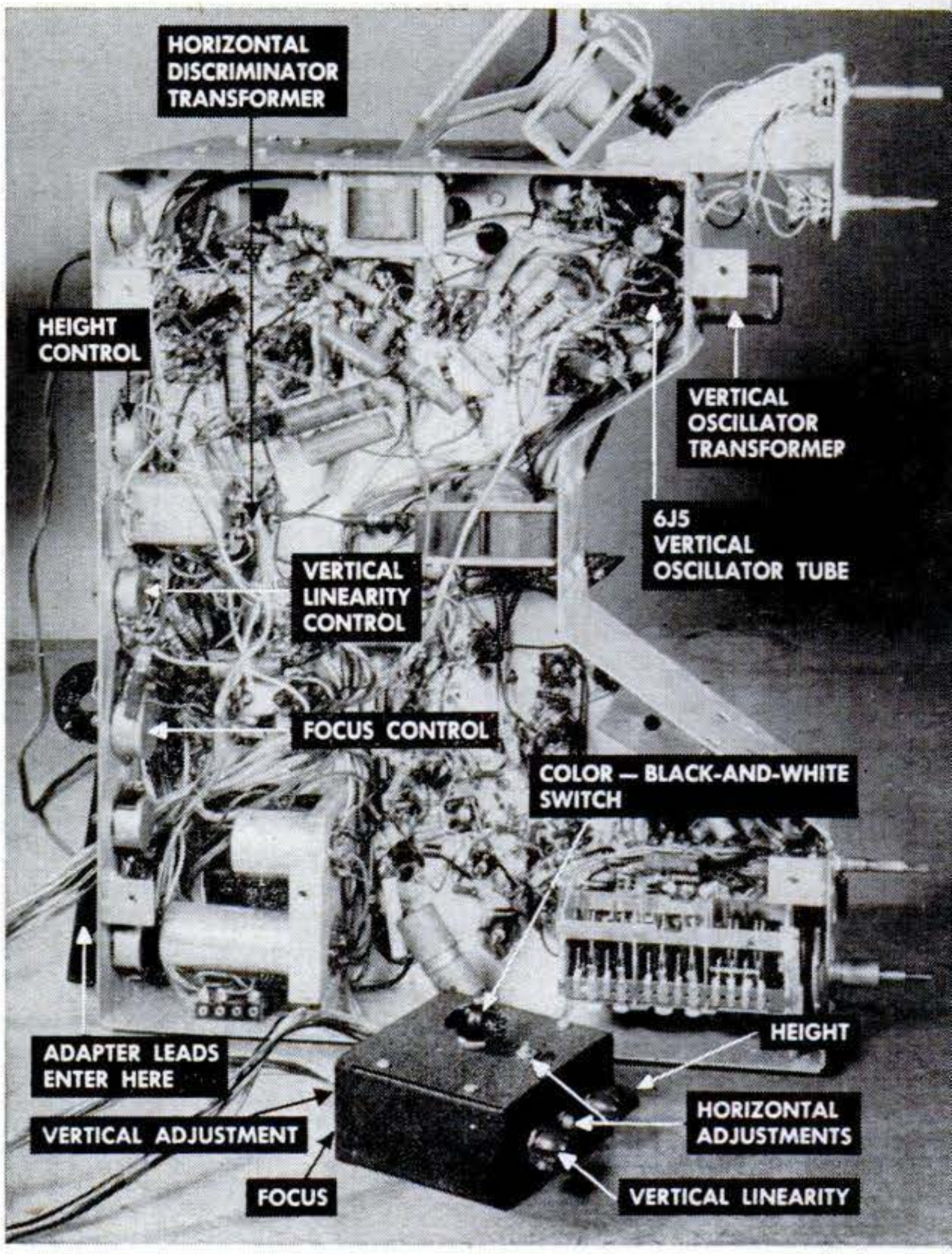
I mounted a two-deck, 8-pole, double-throw wafer switch in a 2″ by 4″ by 4″ steel box and connected all the parts on and around the switch. Only six circuits are affected, so I left two of the eight switch poles unconnected. I put the horizontal and vertical connections on separate wafers.

To keep from getting wires and contacts mixed up, I worked out the code shown in the diagrams. I numbered the switch contacts from 1 to 18 and taped corresponding numbers on the wires connected to the contacts. I taped the letters *a* to *f* on the leads that go to other points in the box.

In my receiver I found a single .015-mfd. capacitor connected between terminal A on the horizontal-discriminator transformer and pin 5 of the 6AC7 control tube. In many 630s there is an additional .0012-mfd. capacitor—shown by dotted lines in the diagrams—in parallel with it. Where two are used, they should both be removed and installed in the adapter as C4.

When I finished, I taped the splices and insulated the shielded cables. Then I reassembled the receiver and adjusted the black-and-white image as it was before. Next, I tuned in a color broadcast, switched the adapter to "color," and adjusted the new controls. —*Norman L. Chalfin, Culver City, Calif.*





This is the completed installation. Labels show places where wiring changes were made.

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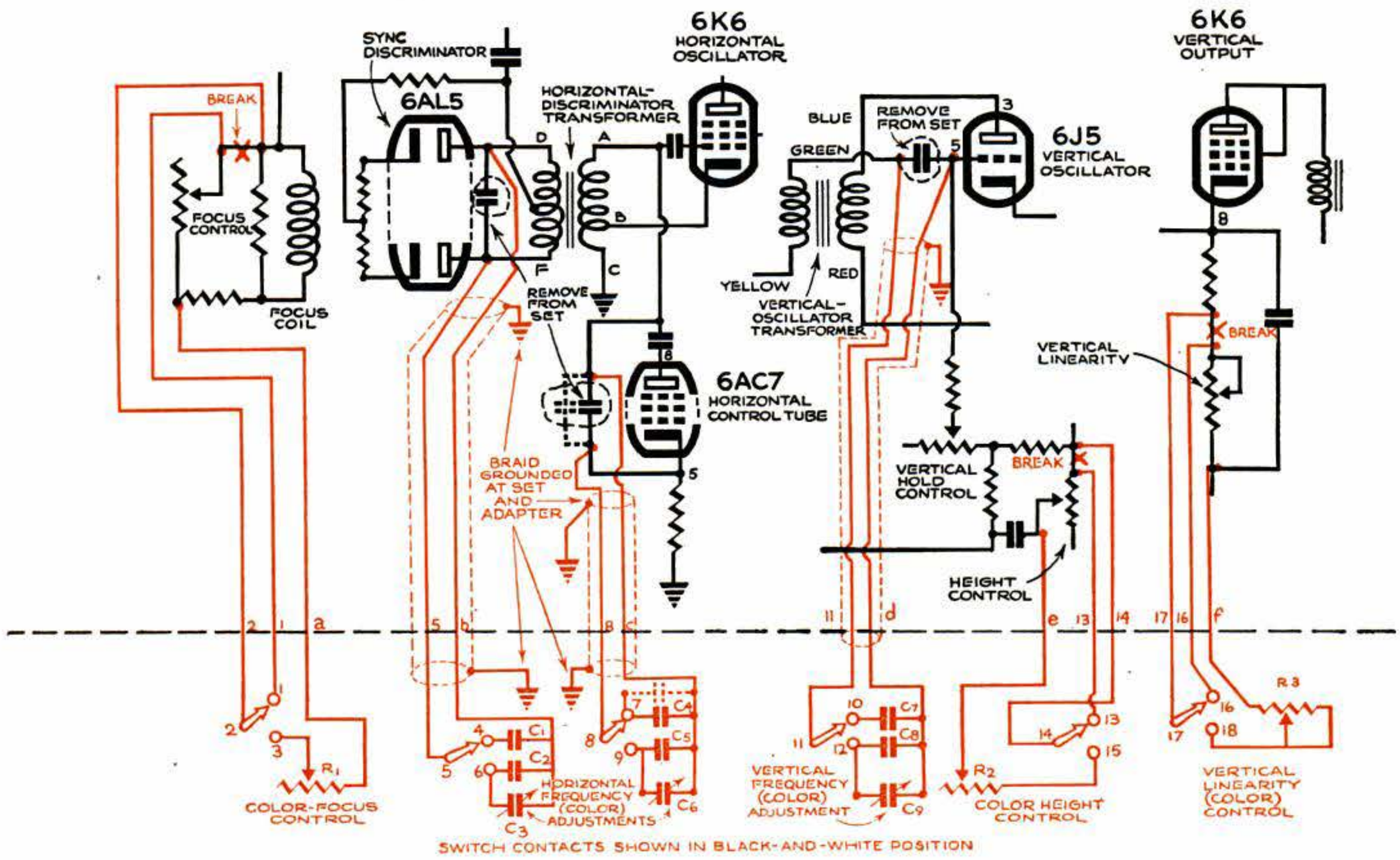
PARTS FOR ADAPTER BOX				SWITCH CONTACT NUMBERS	LEADS TO ADAPTER BOX
CIRCUIT	KEY	PARTS USED	WHAT IT DOES		
Color Focus	R1	1,500-ohm wire-wound potentiometer	Adjusts focus of color picture	1, 2, 3	1, 2, a
Color Phase	C2, C3	.0035-mfd., 400-volt paper cond. (C2) in parallel with .001-mfd. trimmer (C3)*	Allows horizontal "lock-in" circuit to operate at color-scanning rate	4, 5, 6	Two-conductor shielded cable containing wires 5 and b. Shield grounded at set and adapter
Black-and-White (B&W) Phase	C1	.015-mfd., 400-volt paper cond. (may be taken from set)	Restores orig. circuit for B&W reception		
Color Frequency (Horizontal)	C5, C6	.0035-mfd., 400-volt paper cond. (C5) in parallel with .001-mfd. trimmer (C6)*	Raises horizontal scanning frequency to 29,160 cycles for color reception	7, 8, 9	Two-conductor shielded cable containing wires 8 and c. Shield grounded at set and adapter
B&W Frequency (Horizontal)	C4	.015-mfd., 400-volt paper cond. (or .015 and .0012 in parallel. See text. May be taken from set)	Restores horizontal frequency to 15,750 cycles for B&W reception		
Color Frequency (Vertical)	C8, C9	.002-mfd., 400-volt paper cond. (C8) in parallel with .0005-mfd. trimmer (C9)*	Raises vertical scanning frequency to 144 cycles for color reception	10, 11, 12	Two-conductor shielded cable containing wires 11 and d. Shield grounded at set and adapter
B&W Frequency (Vertical)	C7	4,700-mmf. mica (May be taken from set)	Restores vertical frequency to 60 cycles for B&W reception		
Color Height	R2	2.5-megohm potentiometer	Adjusts height of color picture	13, 14, 15	e, 13, 14
Color Vertical Linearity	R3	5,000-ohm potentiometer	Adjusts vertical linearity of color picture	16, 17,18	16, 17, f

OTHER PARTS: Two-deck, 8-pole, double-throw wafer switch (two poles not used)
Adapter box, 2" by 4" by 4" or larger steel cabinet
Three 60" lengths two-conductor shielded cable
Nine 60" lengths No. 18 stranded hook-up wire (color-coded for identification)
*All trimmers are compression-type mica



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Spread out in front of a 1915 Cadillac, borrowed from Hollywood, is the assortment of instruments and gadgets used in recent GM gasoline-economy tests at Phoenix, Arizona.

Vintage 1915 gets the technical task force treatment over Arizona highways. It did 9.5 miles to the gallon. A special *low*-octane fuel mixture, not obtainable today, was blended.

New Engine Cuts Gas Bill

YOUR car uses less gas than your father's did—and your children's will use even less. As fuel and engine efficiency have gone up, gas consumption has gone down.

To find out just how much gas mileage has increased over the years, GM engineers took four Cadillacs out on the desert trails of Arizona. One was a 1915 relic, one a 1935 model, one a '51, and one a '51 car powered by GM's experimental 12-to-1 compression engine. Results?

Since 1915, gas mileage per gallon has more than doubled. Then it was 9.5; today it's 19.8. And with the new engine, it's tripled. The 12-to-1 engine is here, but the higher octane gas it needs isn't. When the two meet—you'll go farther faster on fewer gallons than ever before.

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The scene changes. A 1951 Cadillac, with GM's 19XX experimental engine of 12-to-1 compression, takes the spotlight from its venerable ancestor. A 1935-model Cadillac was also used.

This high-compression engine developed a little too much compression—and blew up. But out of tests like this will come the fast, powerful—and economical—engines of tomorrow.

The high-compression 19XX engine is inspected after a run during which it got 27.6 miles per gallon at 40 m.p.h., about eight miles more than a similar car with a 1951 stock engine.

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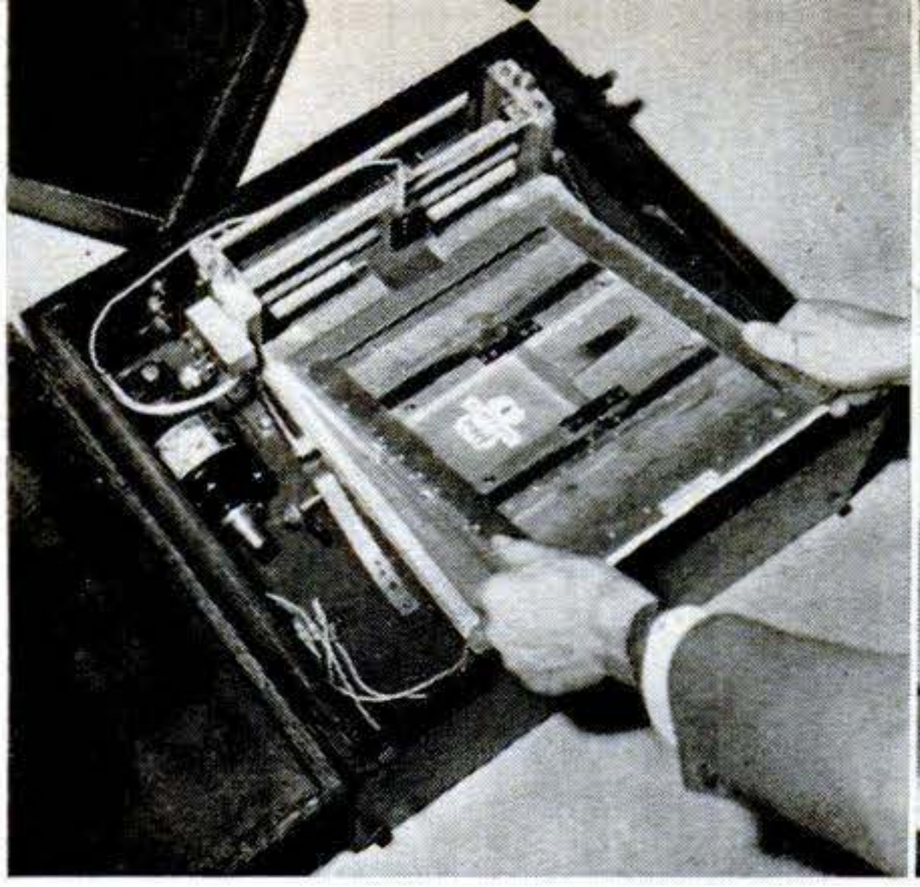


60-Second X Ray Speeds Diagnosis

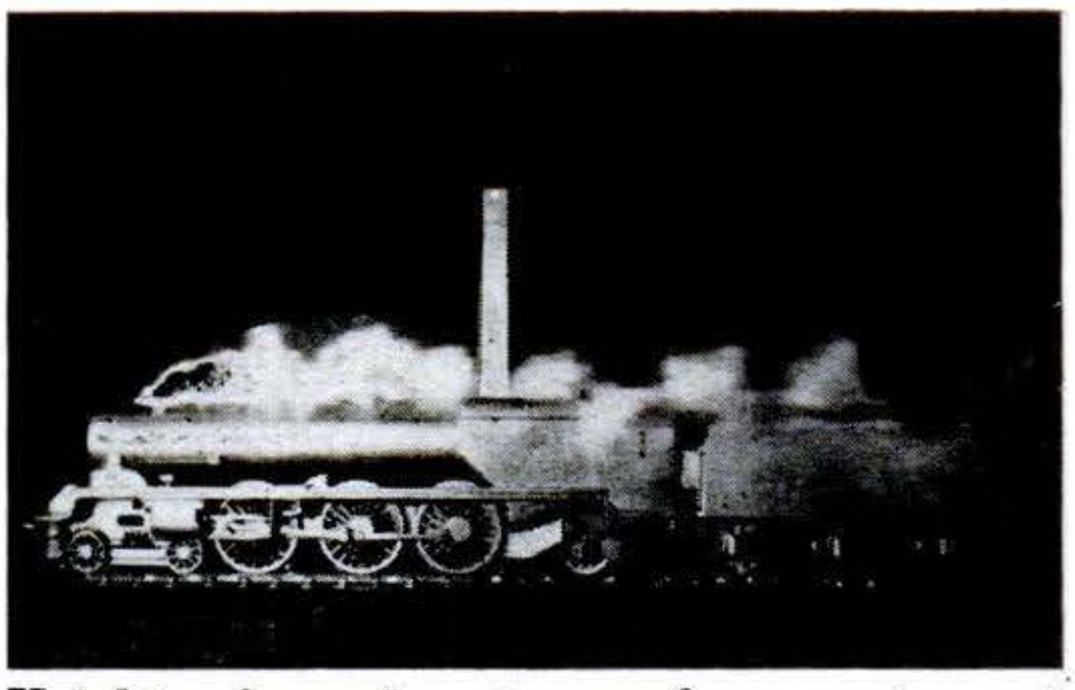
NAVY doctors can now see a fully developed X-ray photo one minute after it has been made. An adaptation of the self-developing Polaroid Land camera (PS, Jan. '51, P. 138) eliminates bulky darkroom equipment and permits immediate treatment of a wounded man without waiting the usual 30 to 45 minutes.

A special two-layer film, incorporating both negative and printing paper, is exposed in the ordinary way, then placed in a small, portable light-tight box (left, above). The film is then squeezed between two motor-driven rollers that break a pod containing jellied developing chemicals and spread them. After one minute, a dry, finished print is removed. Since the device produces a print instead of a transparency, no viewer is needed.

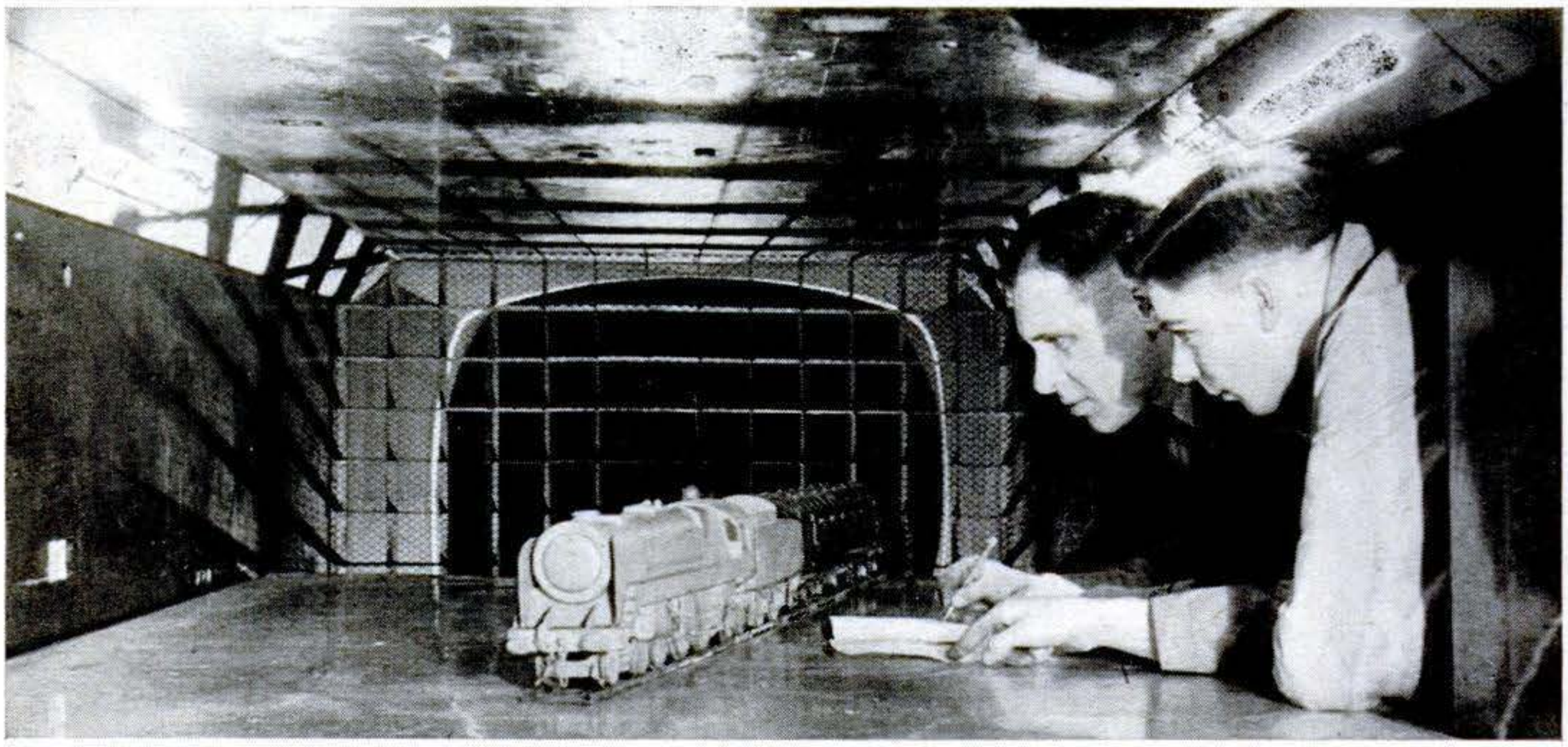
It is also expected to speed surgery when X rays must be made during an operation.

Wind Tunnel Tests Locomotives

THE British are using a wind tunnel to try out new locomotives. Scale models of proposed designs are placed in front of a fan in the chamber below to see what a wind stream does. Such factors as pressure distribution, cooling efficiency, and smoke dispersion are tested. The "ears" on the model below are smoke lifters designed to help channel engine smoke up and away from the train so it keeps out of the engineer's view and the passengers' clothes. The tunnel can simulate speeds up to 60 m.p.h.



Height of smoke stream from engine not equipped with lifters is measured on scale.



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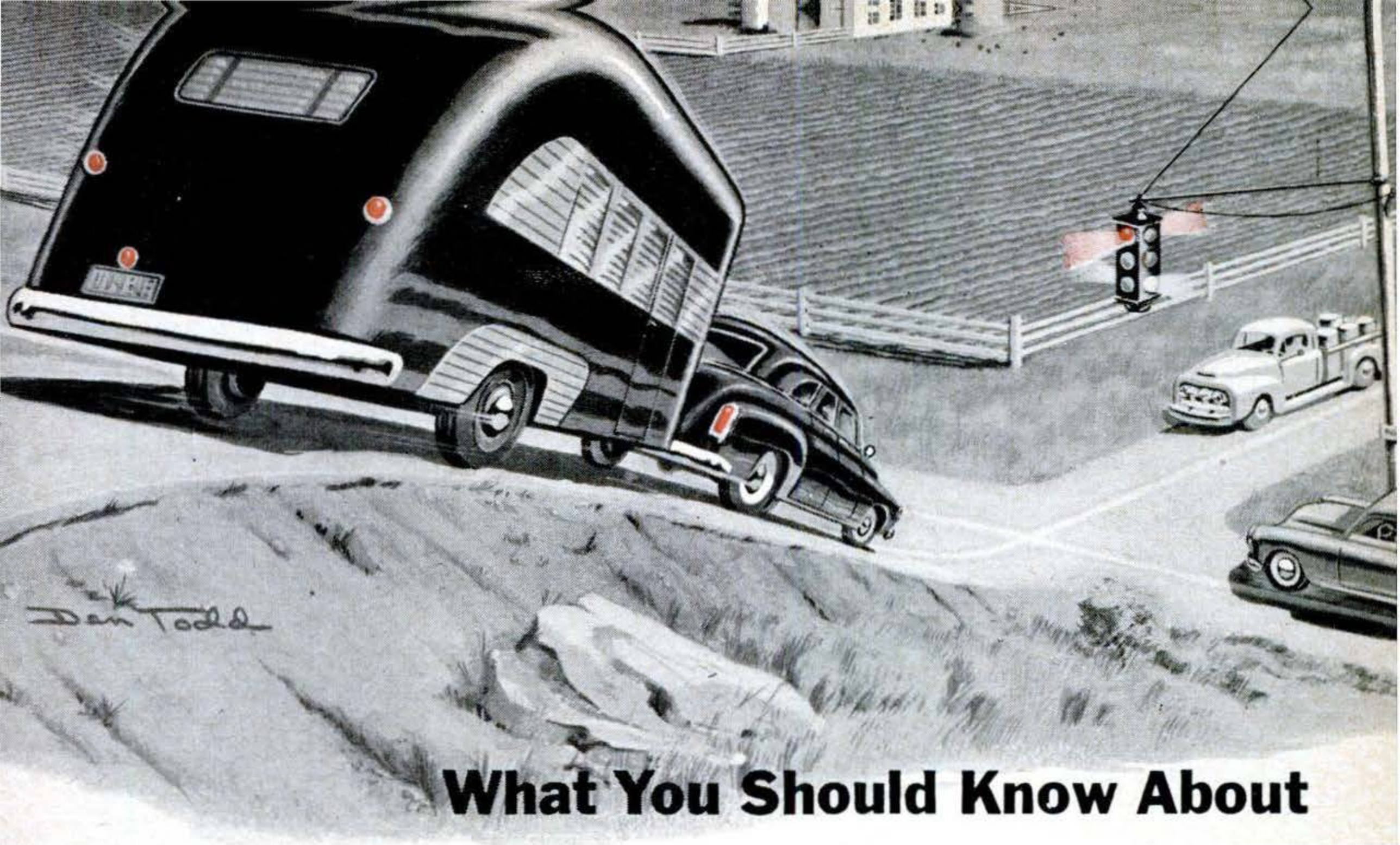


What You Should Know About

Trailer Brakes

Electric brakes in house trailers pose new questions. Before setting out it will pay you to know the answers.

By R. P. Stevenson

WHEN trailerites get together—and the tribe is increasing—you can usually count on one thing: sooner or later, they will start chewing the fat about electric trailer brakes. This story tells you what you need to know to become the life of the party.

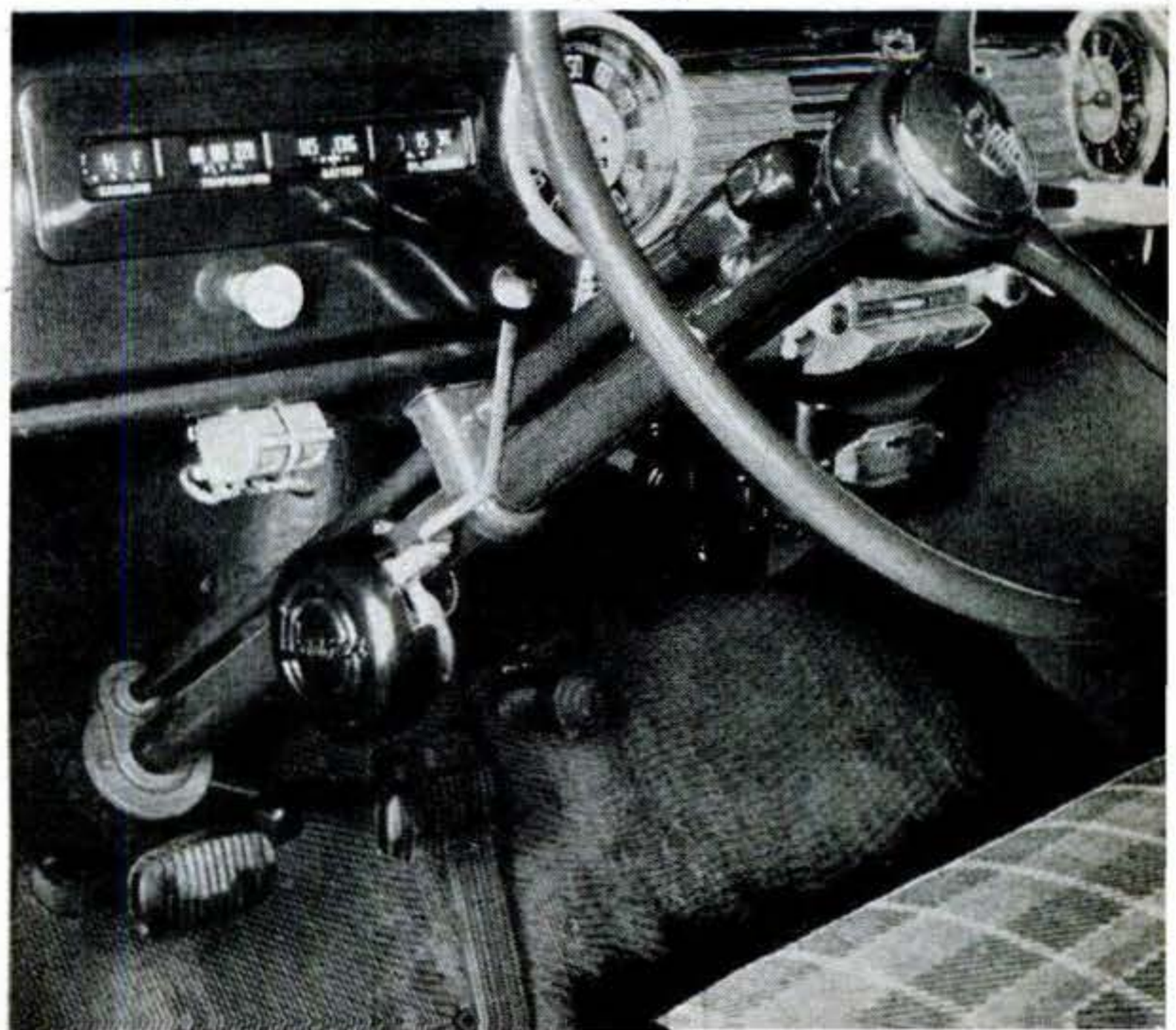
Nearly all big trailer coaches now have electric brakes. Yet few drivers understand them—and the fact that a mechanic is a good man on car brakes is no guarantee he can also service trailer brakes.

These brakes differ in just one big respect from your hydraulic car brakes. In hydraulic systems, cylinders force the bands against the drums. In electric systems, bands still do the braking, but armatures and electromagnets move them against the drums. Current comes from the car's 6-volt system.

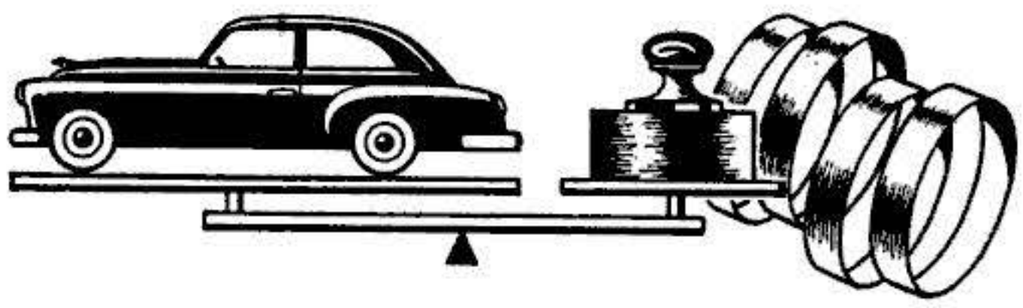
Armature and magnet faces always touch—whether the brakes are on or off. The armature revolves with the drum. The magnet is attached to the backing plate, but can turn with the wheel a fraction of an inch in either direction, depending on whether the trailer is going forward or backward.

Springs keep the armature against the magnet. This means the armature must slide against the magnet even when the brakes are off. The two poles of the mag-

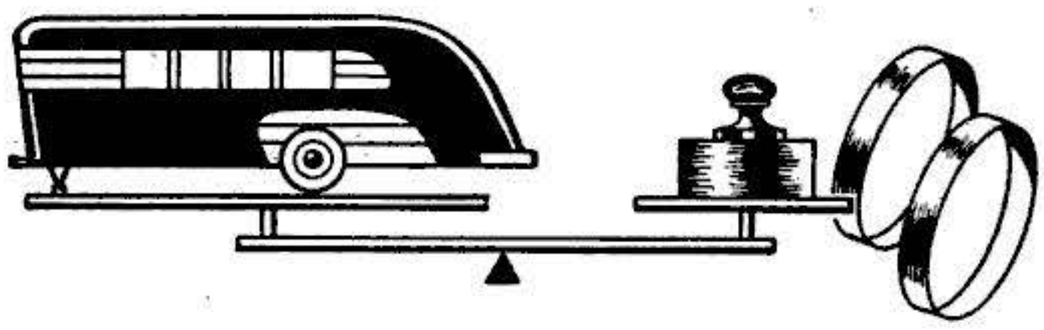
Hand control on left side of car steering column operates most electric trailer brakes. A rheostat, it varies current going to brakes.



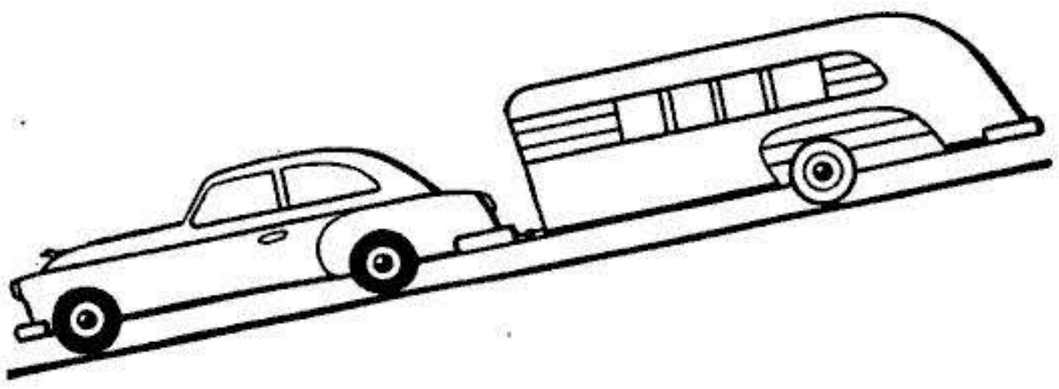
Why You Need Trailer Brakes



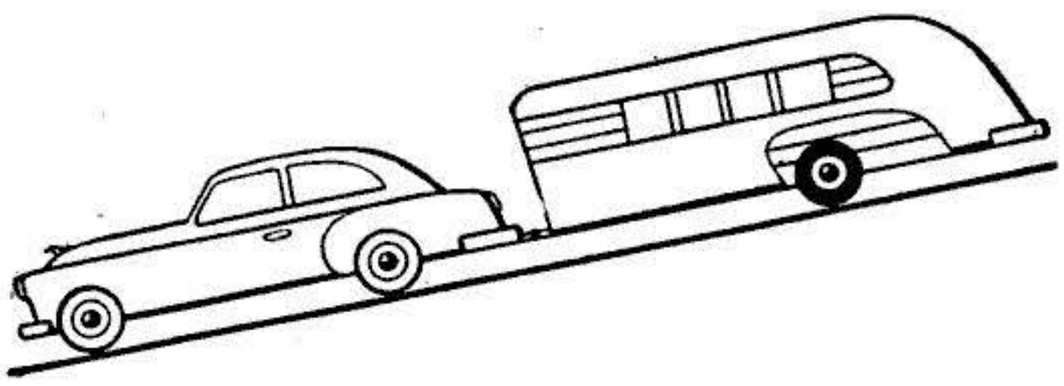
On a 4,000-pound car, four 2″ by 11″ brakes give working drum area of 276 square inches and drum loading of 14½ pounds per sq.in.



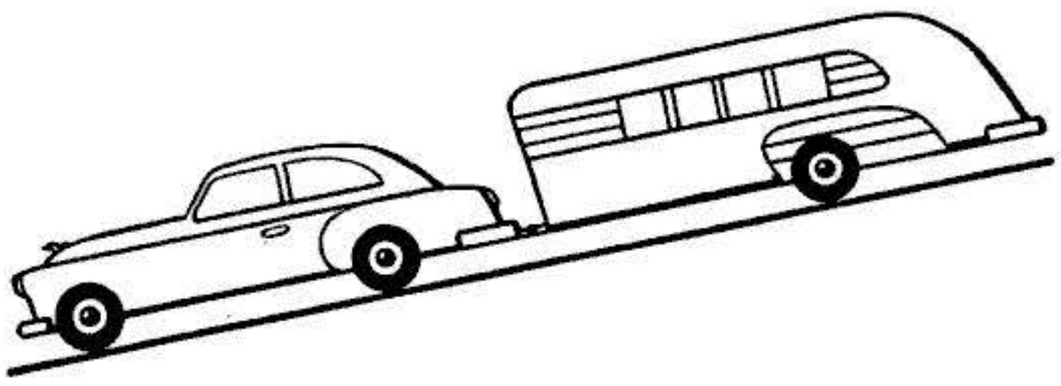
On 3,500-pound trailer with two 1¾″ by 12″ brakes, drum area is 132 square inches and drum loading is about 26½ pounds per sq.in.



If car brakes are used alone, they must stop 7,500-pound total. This makes drum loading 27 pounds per square inch. At 20 m.p.h., driver cannot stop in less than 35.7 feet.



If trailer brakes are used alone, drum loading on them jumps to 57 pounds per square inch. Shortest distance in which driver going 20 m.p.h. can stop is 41.6 feet.



If all six brakes are used, the drum loading evens out at about 18 pounds per square inch. Best stopping distance at 20 m.p.h. then drops to 19.2 feet. Hence, towing trailer is safer.

net gradually wear two concentric rings in the face of the armature. This is normal.

How the brakes work. When you move the brake controller, the magnet becomes energized, attracting the armature with increasing force as you shove the control toward full on position. The magnet finally locks up with the armature and is forced to revolve with it. But as soon as the magnet begins to turn, a lug attached to it forces out a brake band against the drum. When the band begins to press against the drum, the magnet stops turning and the band remains there as long as current is reaching the magnet.

But something has to give. Since the magnet cannot revolve farther, it and the armature become in effect a slip clutch. The armature slips around the magnet. (However, you can slide trailer tires by abruptly jamming the control to "full.") A strong spring pulls the lining clear of the drum when the magnet is de-energized.

Why do you need trailer brakes? Brakes are rated according to drum loading. This is the relationship of the vehicle's weight to square inches of brake-drum surface. In the average car, drum loading is about 15 pounds per square inch.

Your four car brakes were designed to handle this much weight, with a good margin to spare. But piling on a 3,500-pound trailer produces a dangerous overload. You can expect slower stops, overheating, fading, and short lining life.

Electric brakes must be broken in carefully to mate the magnets to the armatures. The firm that makes the trailer brakes, Warner Electric Brake and Clutch Co., recommends this procedure:

1. Speed up to at least 30 m.p.h., apply the trailer brakes *only* until speed is reduced to 15 m.p.h., then let the train regain speed. Don't lock the wheels.
2. Drive for half a mile without using the brakes. Then repeat step 1.
3. Repeat steps 1 and 2 several times—until you have traveled about six miles.
4. Let the brakes run free for about four miles, then apply them again to check their efficiency.

Service procedures that apply to hydraulic brakes also apply to electric brakes. Replace greasy or worn lining with new. Avoid out-of-round or oversize drums. Keep wheel bearings tight. In addition, the magnets must draw the required amperage, and the magnet and armatures must be in con-

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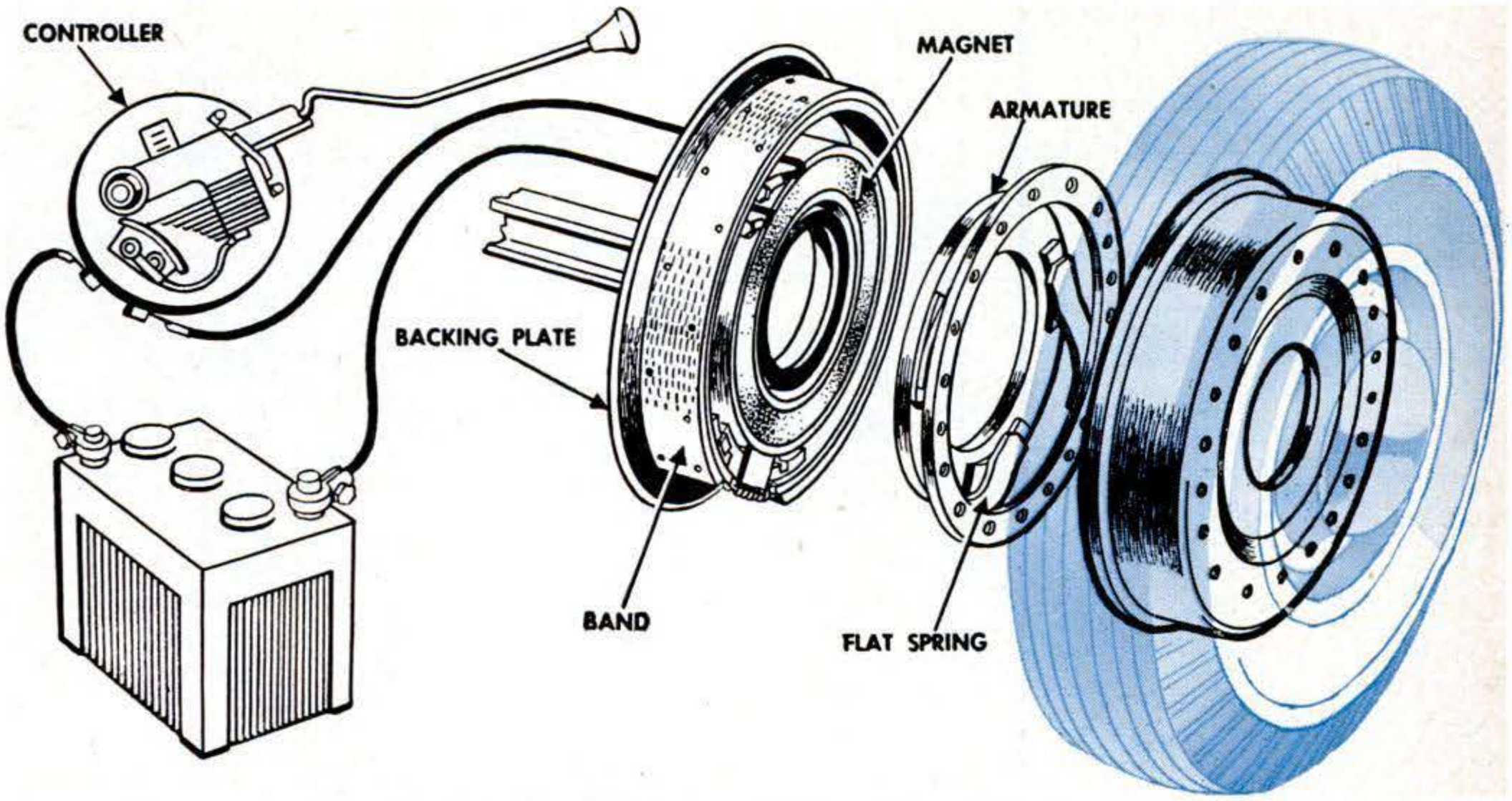
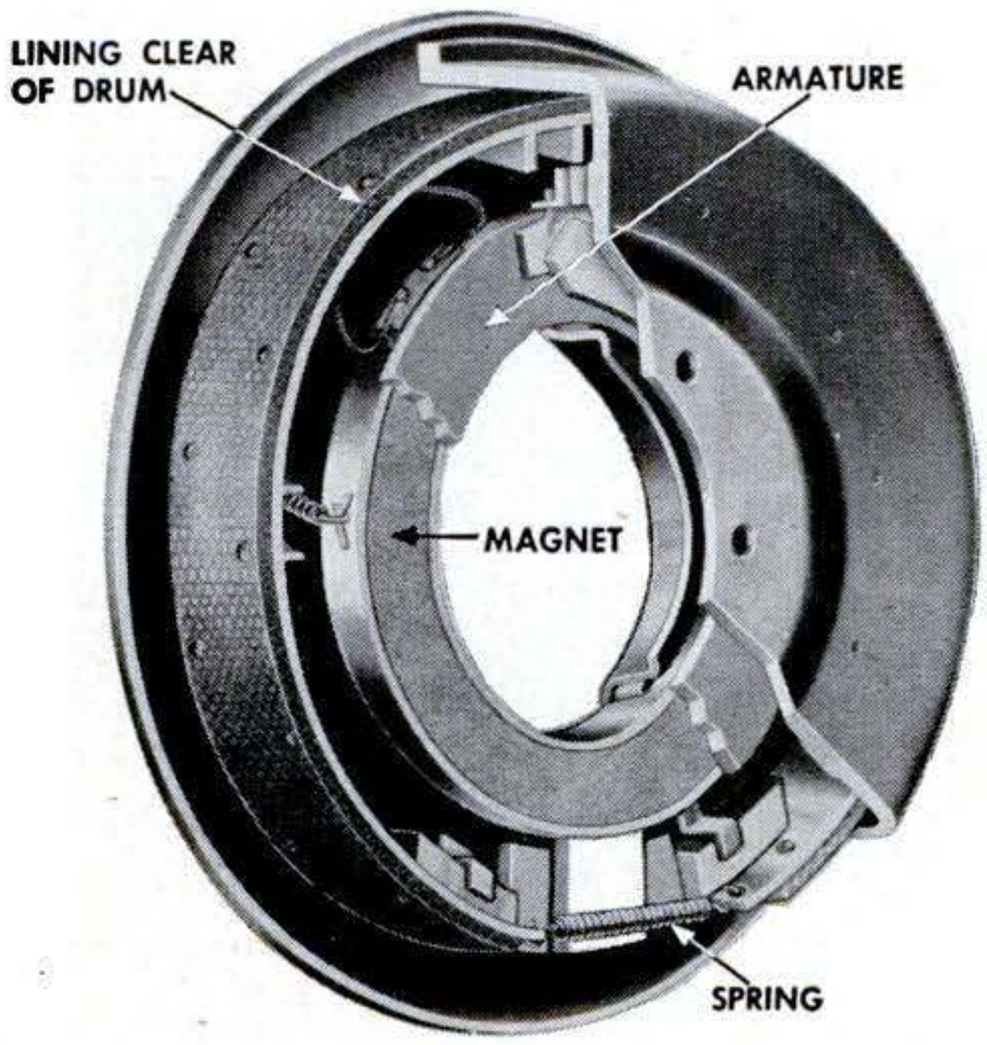
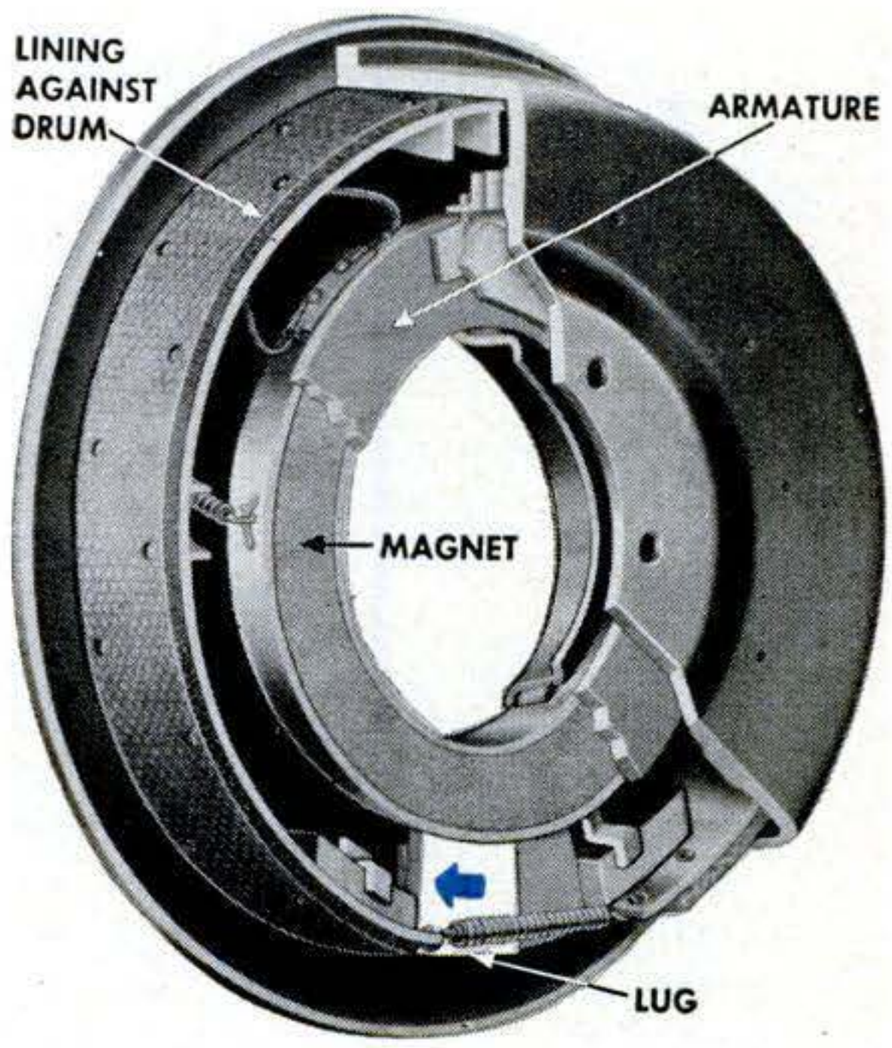
How Electric Trailer Brakes Do Their Job



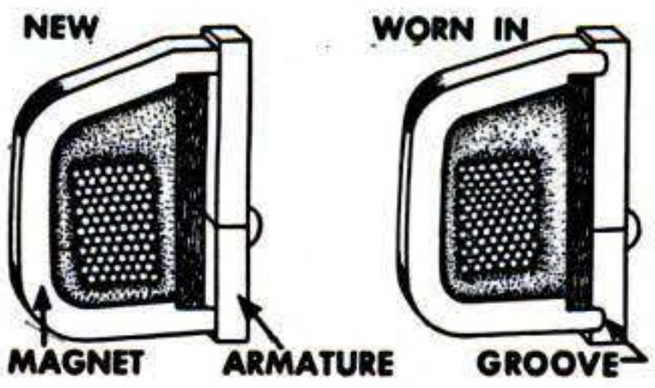
Here are the parts. The hand controller, an eight-step rheostat, delivers current from car battery to electromagnet mounted inside brake shoe. The more current, the greater the braking effort. Magnet is free to move slightly around trailer axle. Armature is attached to drum and revolves with it. Flat steel springs keep armature always in contact with magnet.



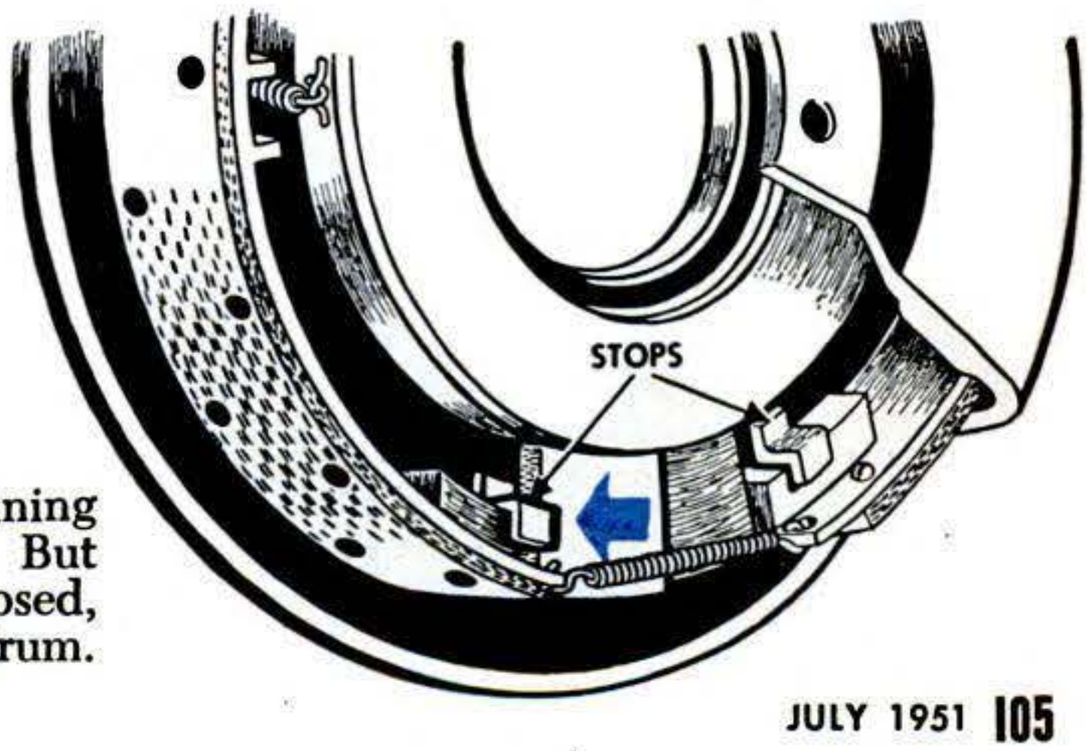
When brake is off, the coil spring at bottom keeps brake shoe contracted and lining away from drum. Armature slides against magnet.



When brake is applied, magnet locks to armature and revolves a bit, forcing lug to throw lining out against drum. Armature then slips.



Magnet poles wears grooves into armature face, at left. Brakes may be noisy while wearing in.



Rivet heads can't score drum. As lining wears, lug moves farther each time. But at point where heads become exposed, lug hits stop, and band can't reach drum.

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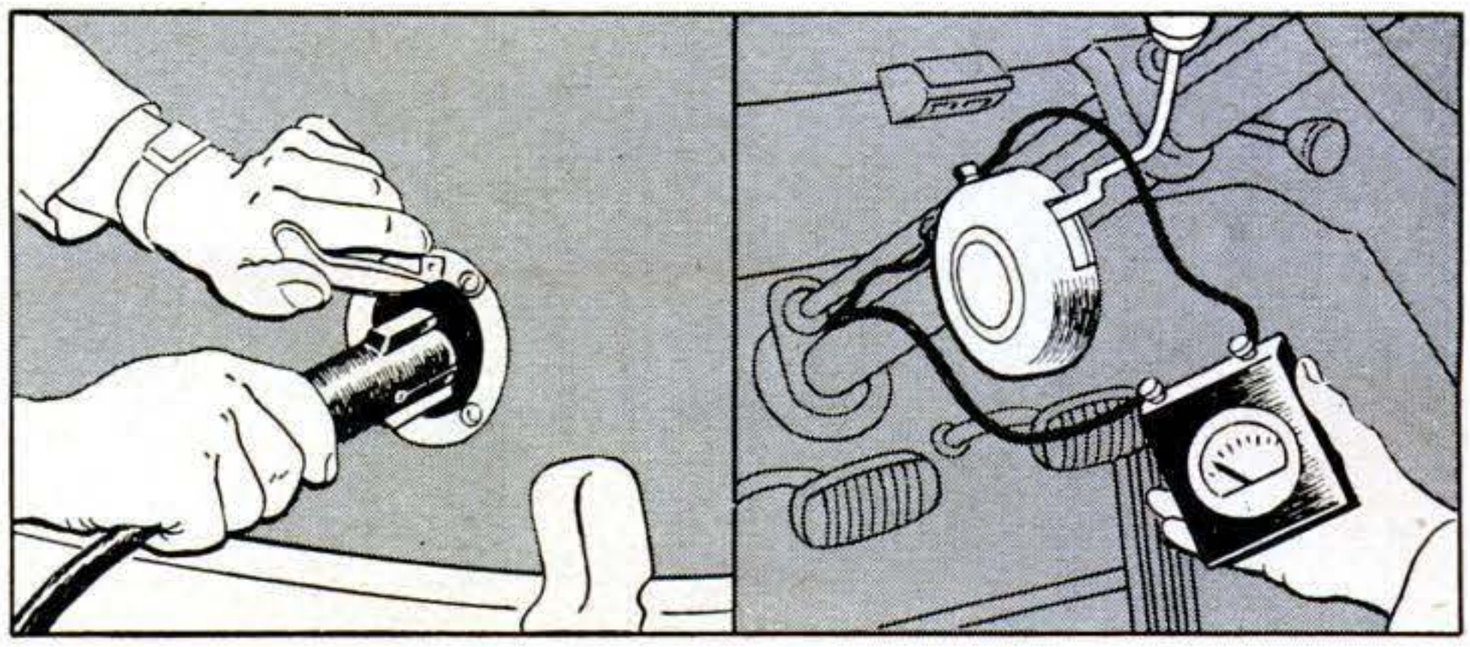
These Tests Help Find Brake Troubles

IF TROUBLE develops in electric brakes, check the electrical circuit first. Experience has shown wiring causes most complaints.

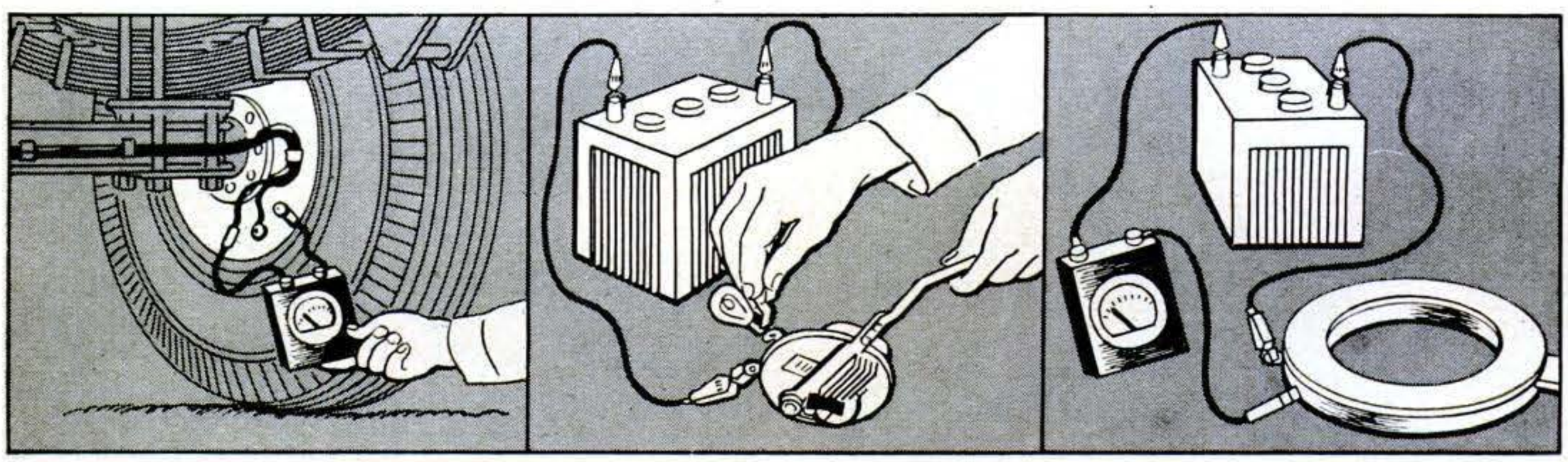
A low-reading DC ammeter is essential. For a two-brake system use one with a maximum scale of 10 to 15 amps. Current draw is so low that a meter of high capacity is less accurate.

Make amperage tests with the controller lever at full on position. Be sure also that engine is running to get full current from generator.



Check all connections first. Loose wires or corrosion on terminals will always give trouble. In making ammeter tests, be sure trailer and car circuits are connected.

Amperage at the controller should be between 5.4 and 8 for a two-brake trailer system with lever fully on. To test, remove one wire and connect ammeter in series.



Current draw at brake should be between 2.7 and 4 amps. Remove one wire from brake and connect meter as above. Check for broken or loose wires if amperage is low.

Test controller by connecting in series with 6-volt battery and a 21-candlepower 6-volt bulb. Lamp should brighten a little more at each successive step as you move handle.

Amperage capacity of magnet can be tested like this. A variation of 10 percent from rated amperage on the name plate is okay. Rated amperage is for 70° temperature.

tact and in correct relationship with each other.

A grooved armature need not be replaced until it is almost worn through. If you replace a magnet, you must also replace the armature—a new magnet would not mate with the old armature. However, you can install a new armature alone.

The brakes are connected to the hot terminal on the starter, and operating current comes from the generator. The return wire goes to the battery ground strap. You may find some body-grounded returns, but they are not recommended. Wire not smaller than No. 12 should be used for the 1¾" by 12" brakes that are now standard on coaches.

Here are other tips for getting the most out of electric brakes:

Use the car and trailer brakes simultaneously. If you wish, you can buy a controller that does this automatically. With it installed in the car hydraulic lines, all you do is press the foot pedal.

When driving on hills, apply the brakes intermittently rather than keep them on steadily.

Never wire the brakes into the stoplight circuit. This would give "on" and "off" brake operation without any graduation of power. The brakes would grab.

If you have parked the trailer for a long period, especially at the seashore, check the brakes before using. Because of rust, you may not have any.

One brake per wheel has been the rule in cars for years. It's a good rule for trailers, too. If your trailer is heavy enough to need four wheels, it needs four brakes.

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'Chute Protects Aussie Trainer Against Student Mistakes

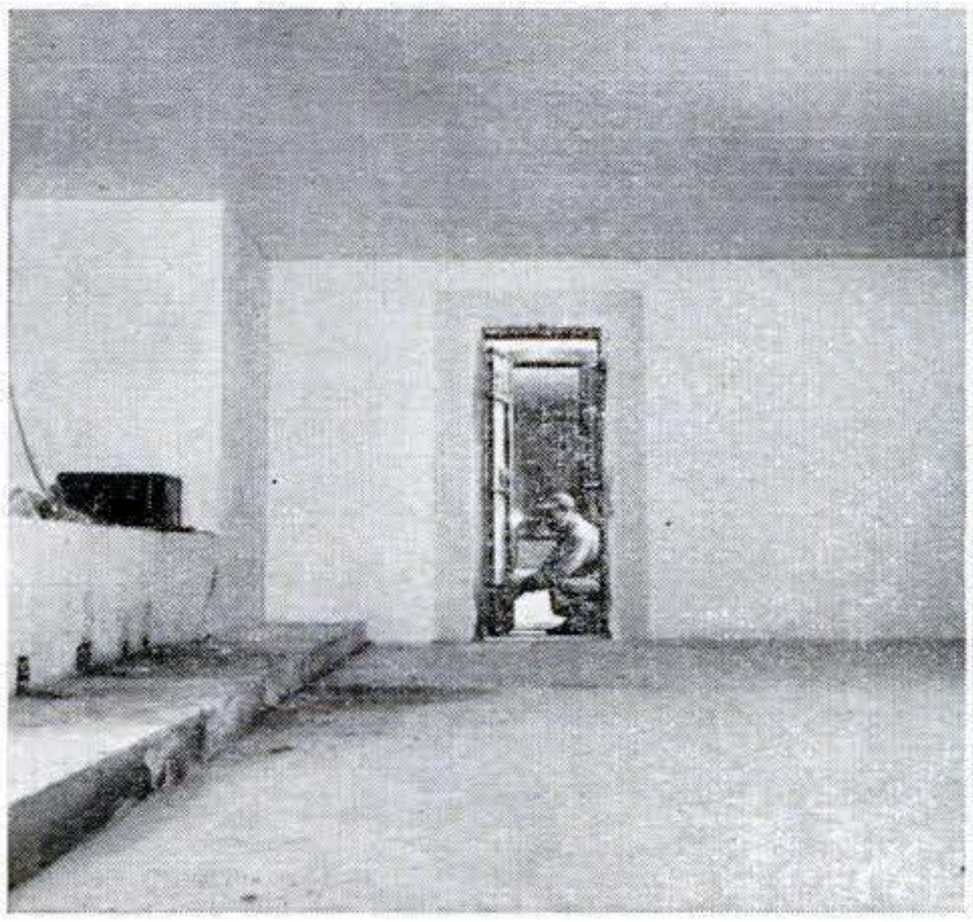
IF A student pulls a bad boner in this new Australian trainer, the instructor can release a built-in parachute that pulls the plane out of an uncontrollable spin. Instructor and pupil sit side by side in the CA-22, and there is a third seat for another student. Built by the Commonwealth Aircraft Corp. for the RAAF, the plane is designed to double in brass as both a primary and advanced trainer. Weighing 4,000 pounds, it can climb 2,000 feet a minute and land at 35 to 45 m.p.h.

Army Medics Get Rapid-Fire Hypo

ARMY doctors don't have to stop to refill or re-sterilize this multiple-shot hypodermic gun—they just keep pulling the trigger. There's no pain because the vaccine is injected by hydraulic pressure through a jet nozzle that doesn't penetrate the skin. Undergoing tests, it is designed to speed mass inoculation in emergencies.

Caves to Guard Treasures from A-Bomb Attack

PERHAPS the mushroom shape of an A-bomb cloud suggested to the Knaust brothers, of Linlithgo, N. Y., that their giant mushroom-growing caves could be turned into a bomb-safe haven for priceless treasures of industry and art. Shaft at right below will be fitted with a 36-ton, time-lock steel door to guard the main entrance. Underground will be 1,000 air-conditioned concrete vaults equipped with scores of safety devices. Photo at left shows a steel door being installed on a vault.



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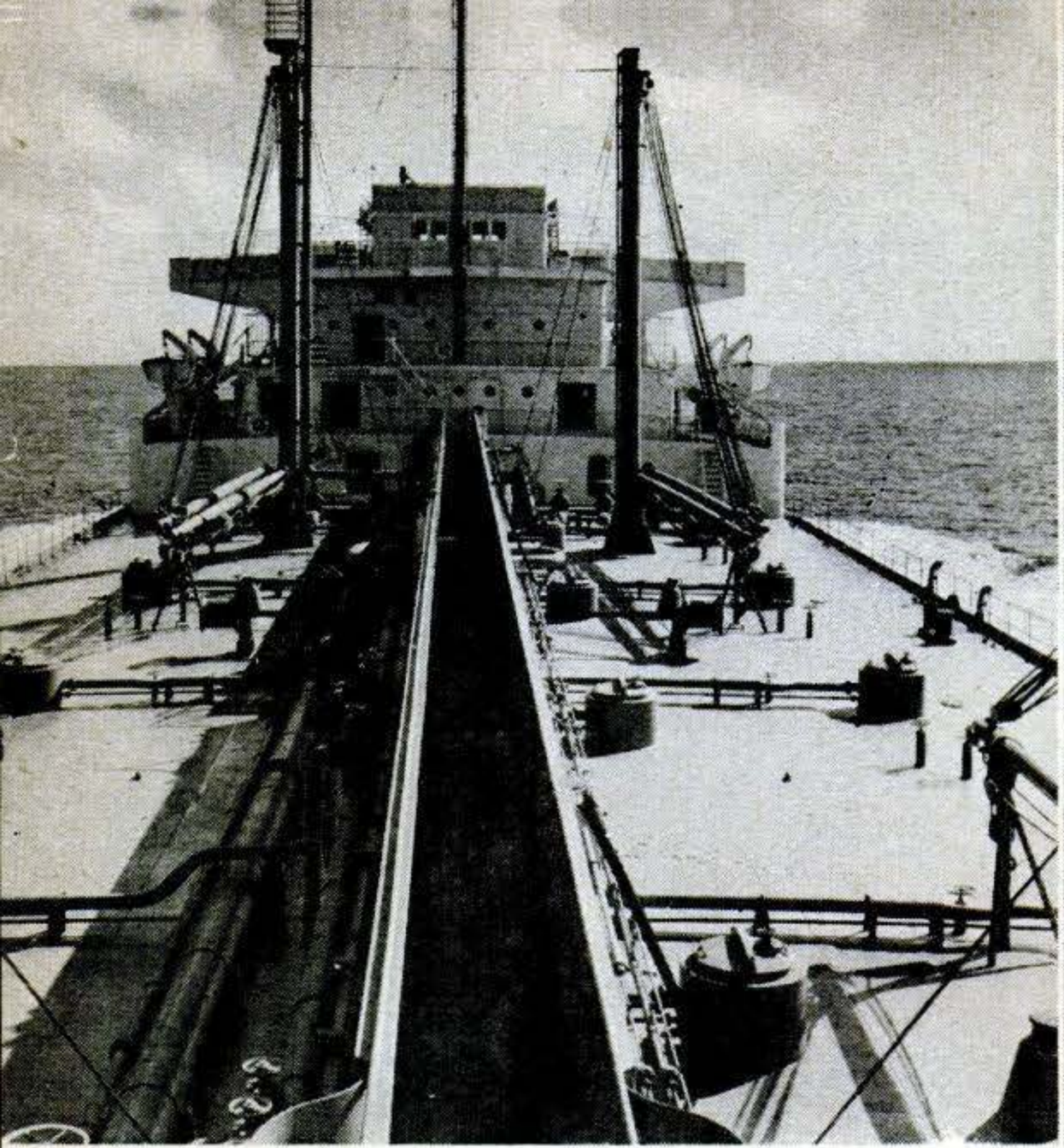
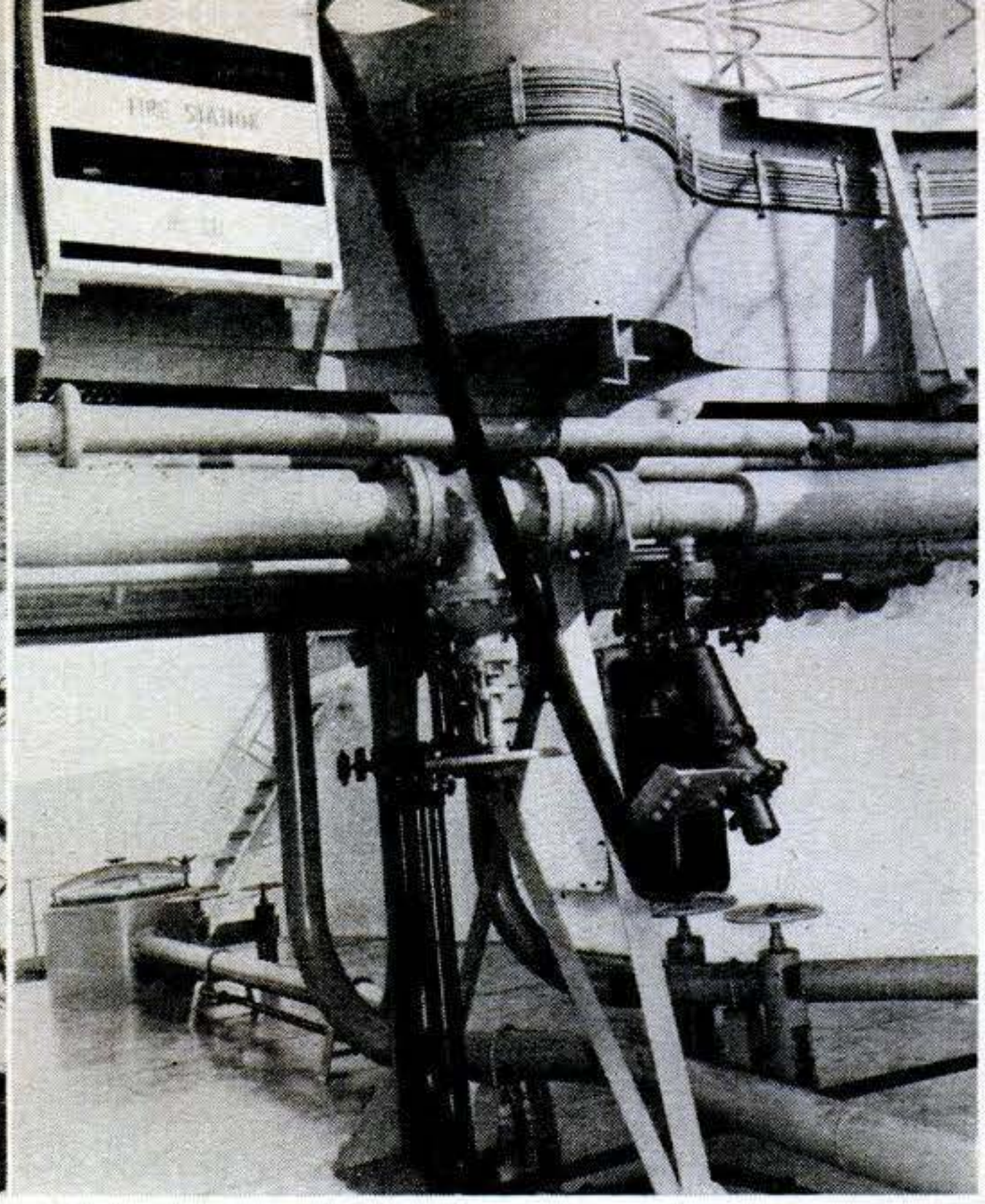


Catwalk, looking toward after housing from bridge, has stainless-steel sides that carry electric cables running length of ship. Foam stations are set along it at regular intervals. Another walk joins bridge and forecastle decks.



Remote-controlled foam station, one of many throughout ship, can smother a fire with six inches of foam in three minutes. Tanker is first with complete, built-in foam installation (capacity 170,000 gallons) to guard against fires.

GRAVITY DAVITS FOR LAUNCHING LIFEBOATS

CREW'S MESS

OFFICERS' MESS

BOILER ROOM

ENGINE ROOM

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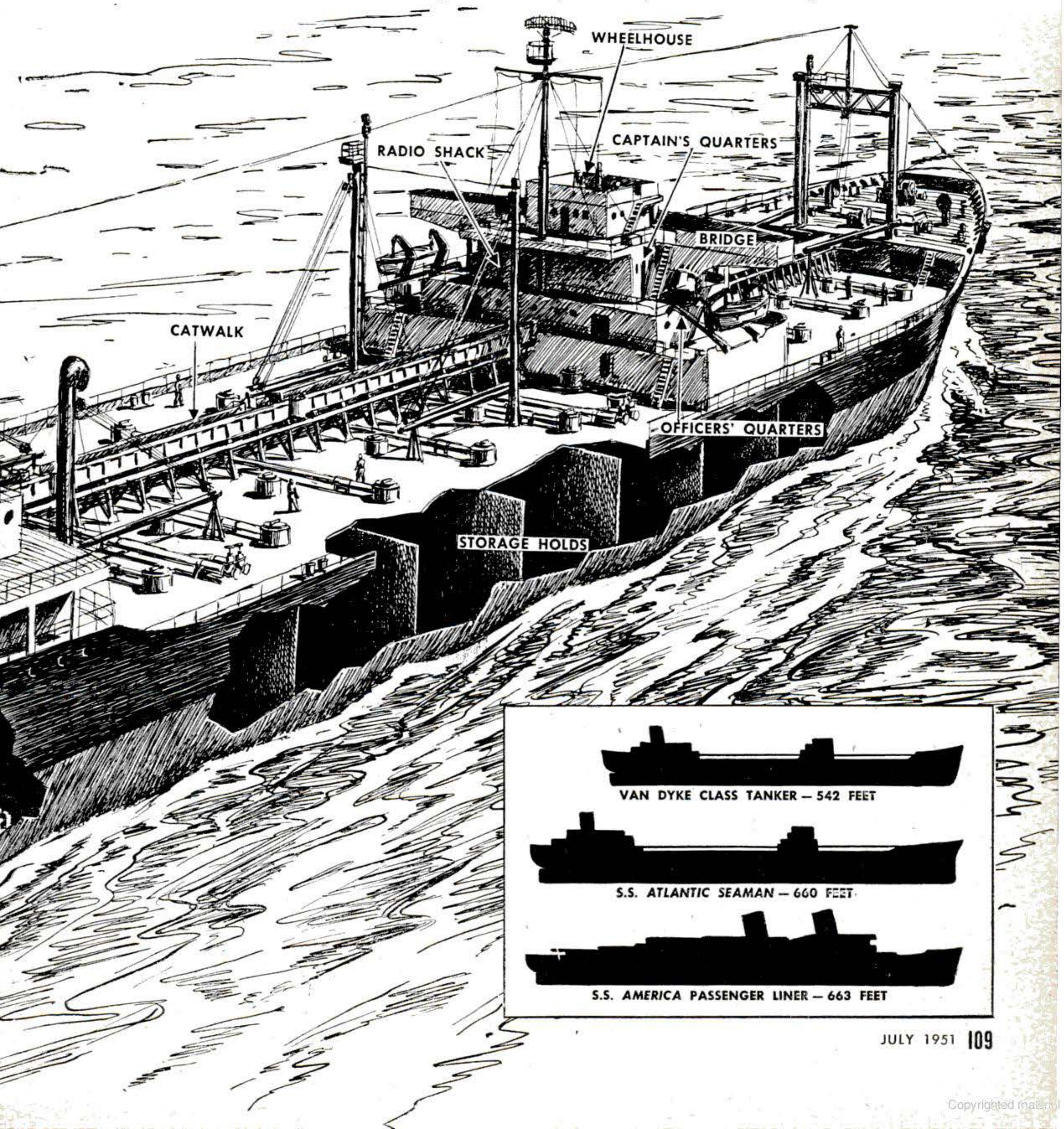
Largest Oil Tanker Totes 10 Million Gallons

THIS is the largest, hottest, and one of the fastest tankers afloat, the S.S. *Atlantic Seaman*. Displacing 30,155 tons, she carries as much oil as a thousand tank cars. Filled with gasoline, she could give more than 16,000 motorists 10,000 miles of driving apiece.

The bigger the ship the less it costs per barrel to haul oil in bulk from foreign fields. The *Atlantic Seaman* holds 257,935 barrels —10 million gallons. On her maiden voyage, the tanker averaged better than 18 knots. Her steam turbines, designed to develop 18,000 shaft hp., use the hottest steam of any ship on the seas—1,020°F.

Built by the N. Y. Shipbuilding Corp. for the Atlantic Refining Co., she has now been joined by two sister ships. END



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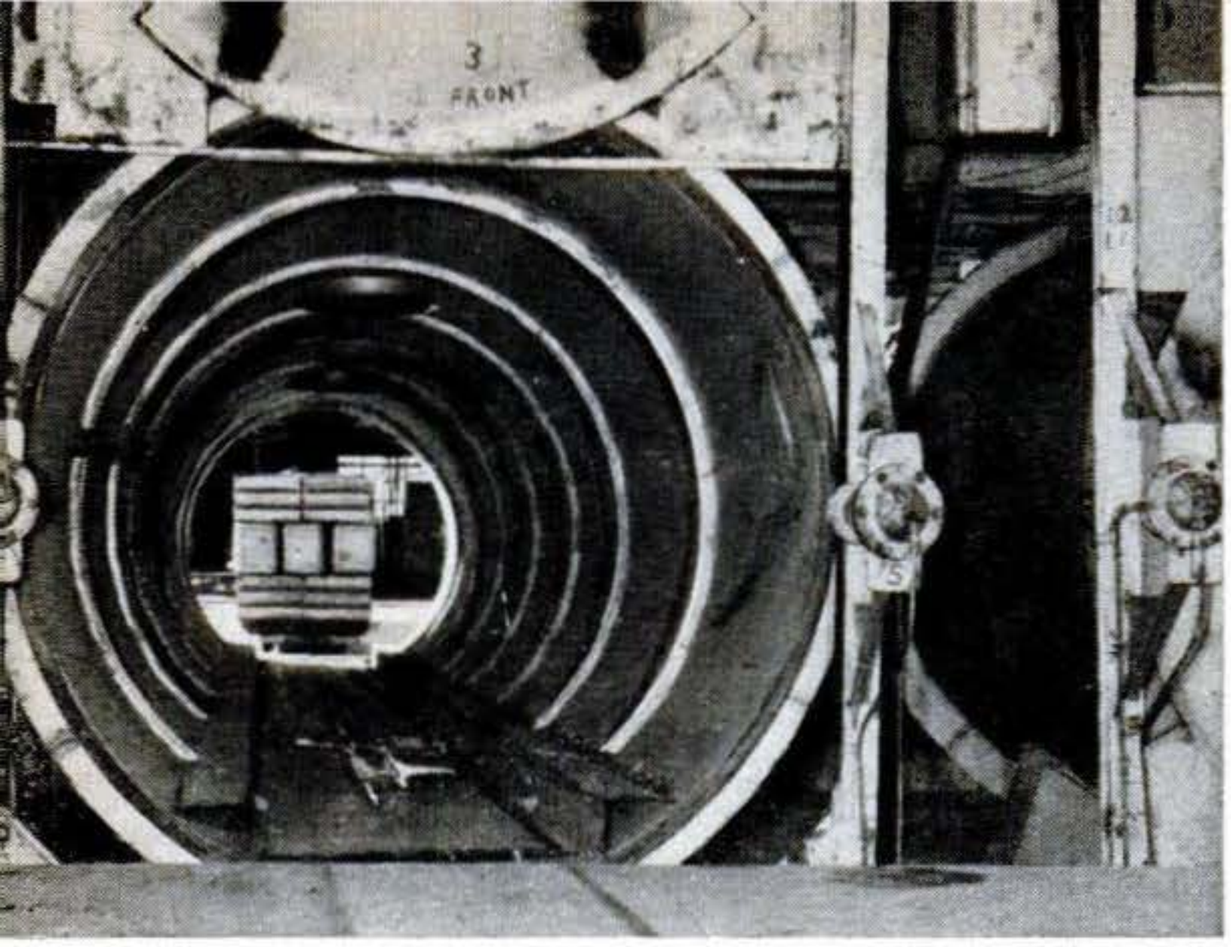


Steam Chills Fresh Vegetables

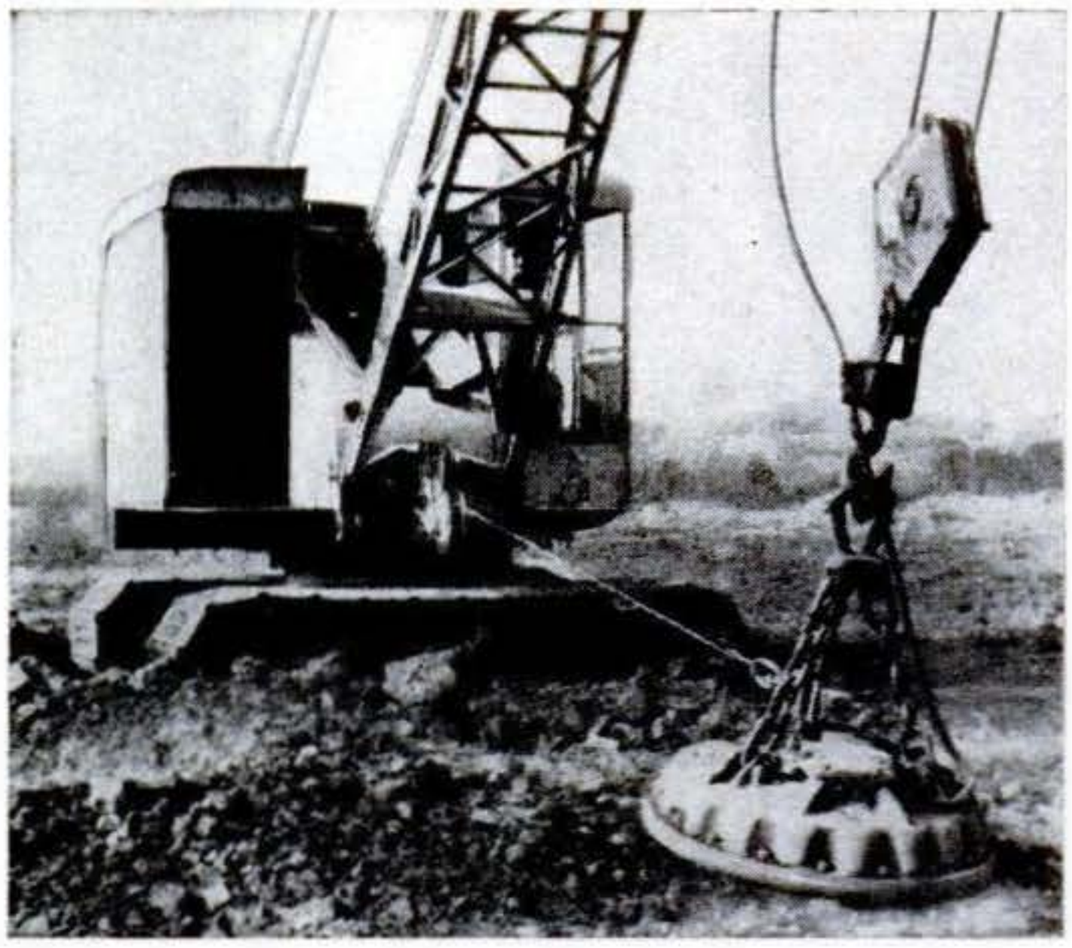
HOT steam will chill some 125,000,000 heads of California lettuce this season to bring crisp greens to the salad plates of America. When the cart of lettuce crates has entered the 50-foot-long steel cylinder above, end doors are shut. Jets of steam rushing through venturi tubes exhaust air, and evaporation flash-cools the lettuce to 33°F. The process, developed by the Vacuum Cooling Co., is adaptable for chilling other vegetables, and is claimed to save 15 tons of ice on a transcontinental train run.

Mae West Slimmed for Junior

WHEN the family of a GI or a general flies overseas to a new post, daddy's little dividends now will wear their own pint-size life preservers. Developed by the Air Force and Goodyear, they work just like the big ones, except that the carbon dioxide cylinders and inflation valves are located behind the neck, where tiny fingers can't tamper with them. They also can be blown up by mouth. Shown above are the two sizes: one for children six months to six years, and the other for six- to 14-year olds.

Magnet Mines Scrap-Iron Dump

A SHORTAGE in scrap steel sent the big electromagnet at right snuffing into a slag pile near Coatesville, Pa., that has been built up with waste from nearby mills over the last half century. In one month, 3,500 tons of scrap iron, essential to making new steel, were recovered from this one slag heap. Operation Scrap Salvage is part of a steel-industry campaign to avert a 7,000,000-ton shortage forecast for the end of 1952. Besides raking up their own back yards, steelmakers have appealed to other industries and to the public to *scrap*, not dump, old plants and equipment that have iron and steel parts.



Endless Belt Cleans Up Oil Slick

A HARBOR fire hazard will be lessened with a Navy device (left) that sops up oil floating on water. Mounted on the bow of a barge, as in drawing below, its moving belt, of absorbent felt, skims the water's surface and "drinks" up oil. The oil is then squeezed out by rollers at the top. It can clean up 100 gallons of oil an hour.

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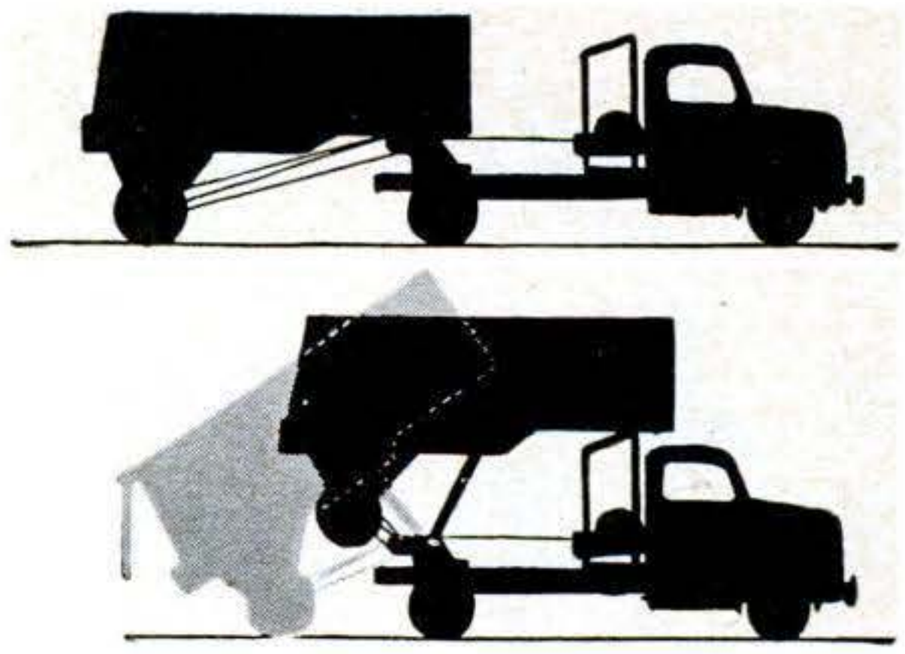
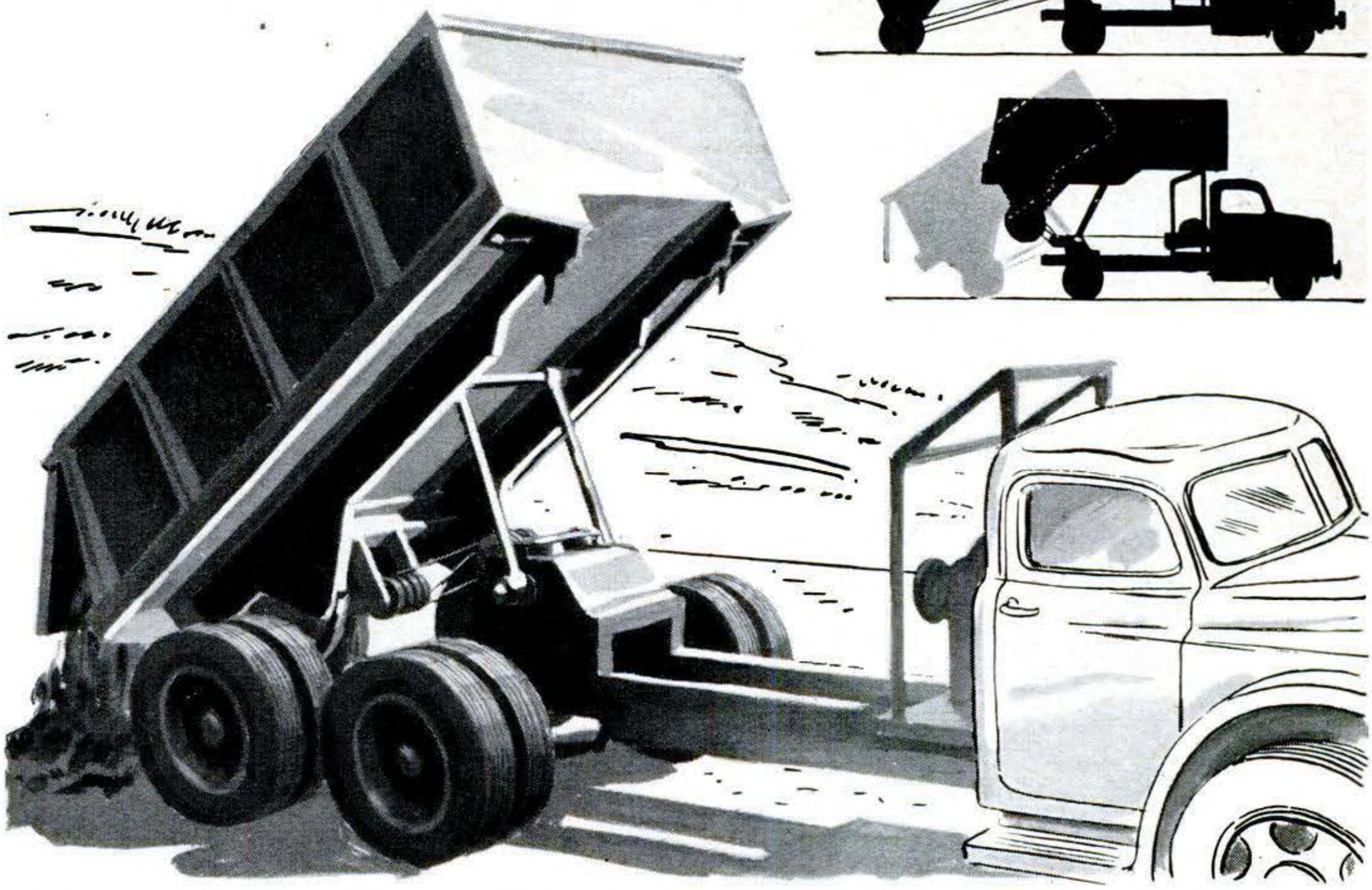
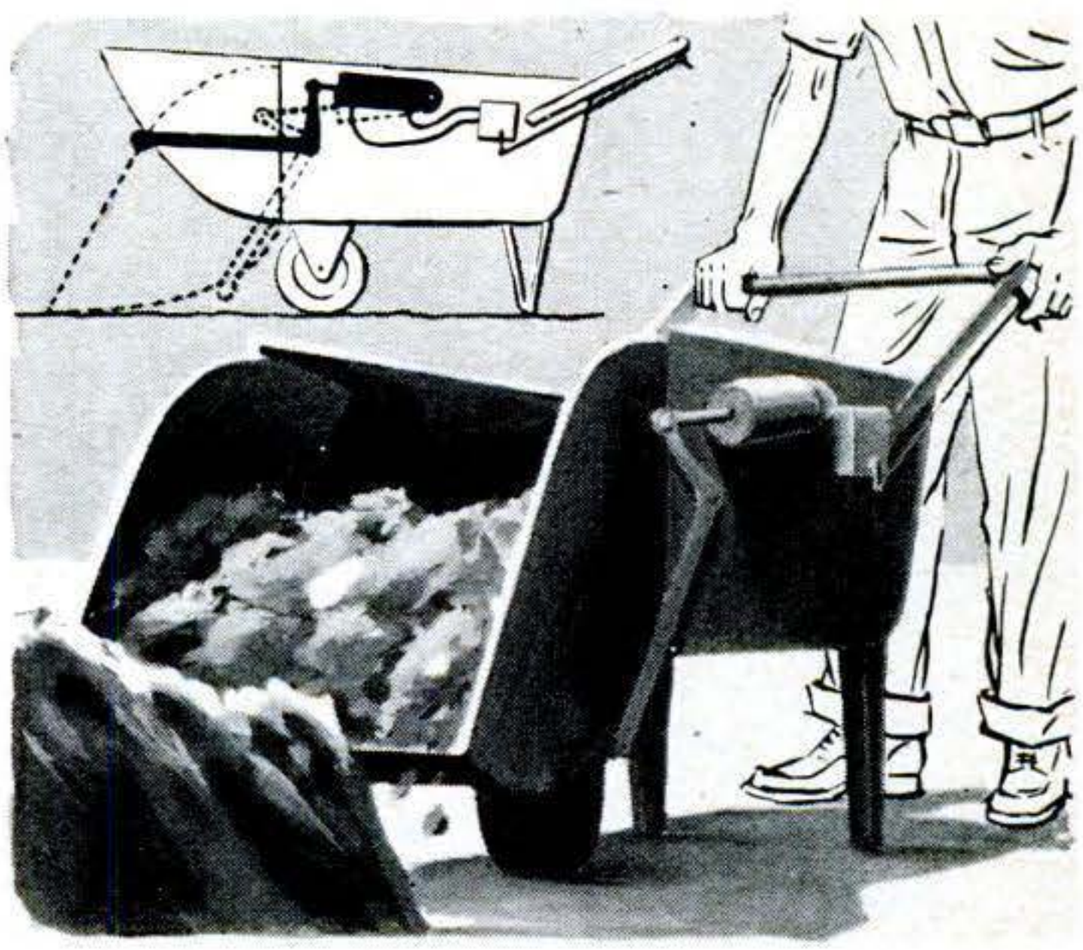
New Ideas from the Inventors





1 Winch to Dump Trailer. This dump truck just pulls in its rear when it wants to unload or park. Saving a complicated and costly hydraulic lift, the trailer is connected to the cab simply by a winch cable and two pivoted rods. As the winch reels in the trailer, the rods tilt it upward, dumping the load. Further winding pulls the trailer up and over the cab for parking in small spaces.

2 Postman's Raincoat to Cover Bag. No soggy letters would be delivered by a mailman wearing this raincoat. It has a built-in section covered with a transparent flap to accommodate the mailbag. By reaching under the flap, the postman could read addresses and arrange his mail without exposing the letters to the elements.



3 Wheelbarrow to Load Itself. This wheelbarrow is designed to scoop up dirt as well as carry it around. A hydraulic cylinder, operated by a lever near the wheelbarrow handle, does the work. It lowers the front end of the wheelbarrow so it can serve as a scoop, then raises it when it is filled with dirt or other material.

Turn the page, please, for three more new ideas.

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MORE New Ideas from the Inventors

4 Vibrator to Mix Drinks. A thin paddle would churn up chocolate milks and other drinks by vibrating back and forth instead of spinning in this portable mixer. The mixer's motor would consist of a solenoid coil, which, when plugged into an A.C. supply, would oscillate an iron armature fastened to the paddle.

5 Bombs to Get Jet Assist. To give armor-piercing bombs dropped from low-flying planes the acceleration they need, this patent, assigned to the U. S. Navy, would shove them on with a jet in the tail section. The unit would be triggered automatically to go into action toward the end of the bomb's normal fall.

6 Plate to Have Built-In Warmer. Electrodes in a sealed well under this plate would turn water into steam to keep the plate hot. The steam condenses on the underside of the plate. The water acts as an automatic switch, shutting off current when the well boils dry, then turning it on when condensed water refills the well.

Patents on these inventions have been granted to: 1. F. Clement and C. Watson, Minden, La.; 2. J. Karow, Milwaukee, Wis.; 3. S. Kronhaus, Los Angeles, Calif.; 4. A. Wilcox, Chicago, Ill.; 5. C. Hickman, Jackson Heights, N. Y., R. Graumann, Alexandria, Va., and R. Mallina, Hastings, N. Y.; 6. I. Ellsworth, Belmont, and R. Farrar, West Acton, Mass.

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How Zip Is Put into Golf Clubs

Delicately matched clubs, once custom-made and costly, now come off assembly lines with the precision built in.

LAST year, America's five million golfers bought more than 25 million golf clubs. That means that every player, from dub to pro, invested in an average of five new clubs in the quest for lower scores.

To make that many clubs requires a forest of persimmon trees for the heads alone, close to 50,000 tons of steel, and the skills of thousands of craftsmen.

One major source of this tremendous yearly club supply is the Chicopee, Mass., plant of A. G. Spalding Bros., where these photos were made. If you were to visit the plant on a typical busy day, you would find a stream of more than 75,000 clubs flowing down the production line. If you looked closely, you would also find that the majority of these clubs progress from one manufacturing step to the next in groups of four, six, and eight. These are the "matched" or "registered" sets, so designed and built that the feel—club makers call it the "swing weight"—is the same for each club. And if you lose or break a club, you can send in its registration number and get a new one just like it. There's even a mechanical golfer—the Dyna-Matcher—that tells how a club will feel when you swing it.

1 Persimmon wood is used for heads of most wood clubs because it is fine-grained, dense, and stands up under impact. Persimmon blocks, left, are first cut roughly to shape of club head on a bandsaw. Then each block is tested for proper density. *[Continued on next page]*

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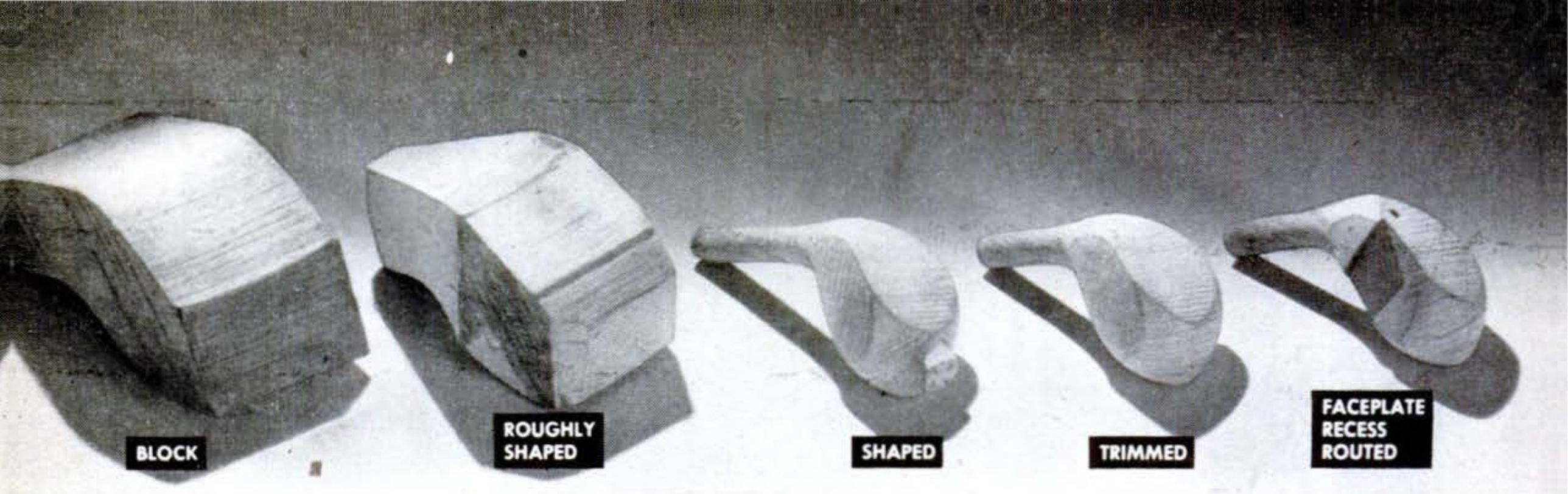
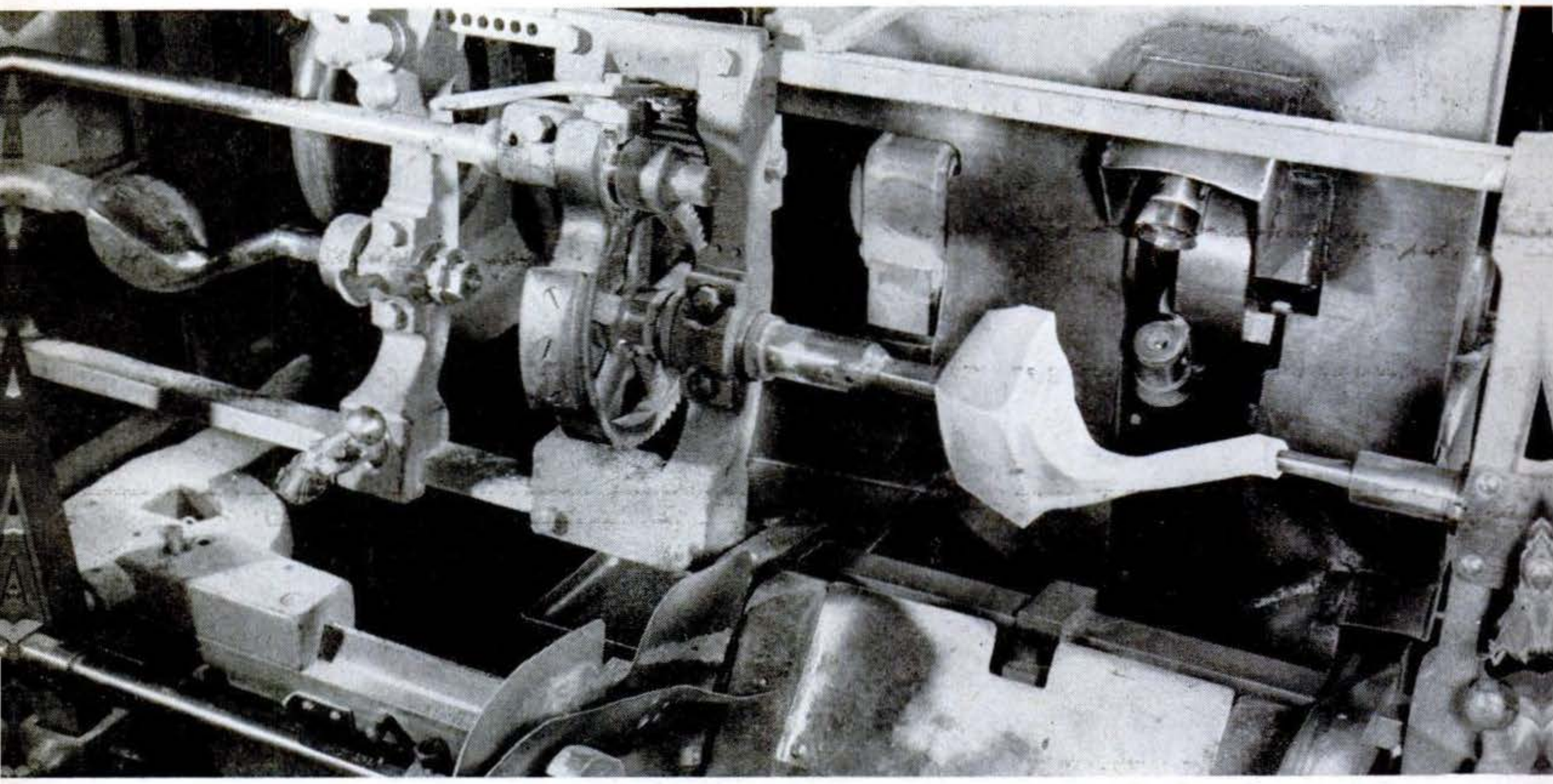


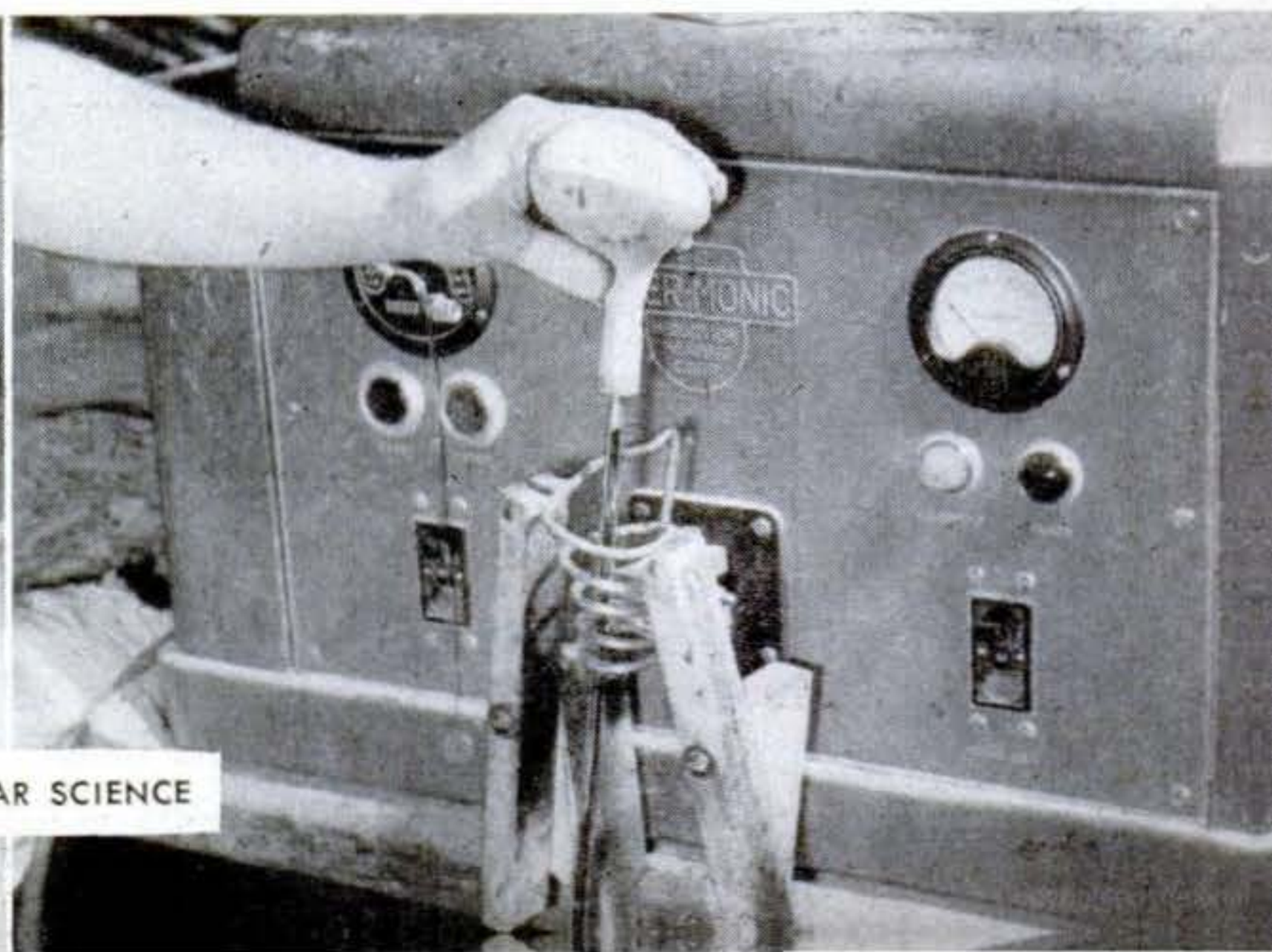
2 **Ten basic steps** in making wood club. At left above is rough bandsawed persimmon block. After successive shapings, club head, attached to shaft, is ready for sanding and stain-

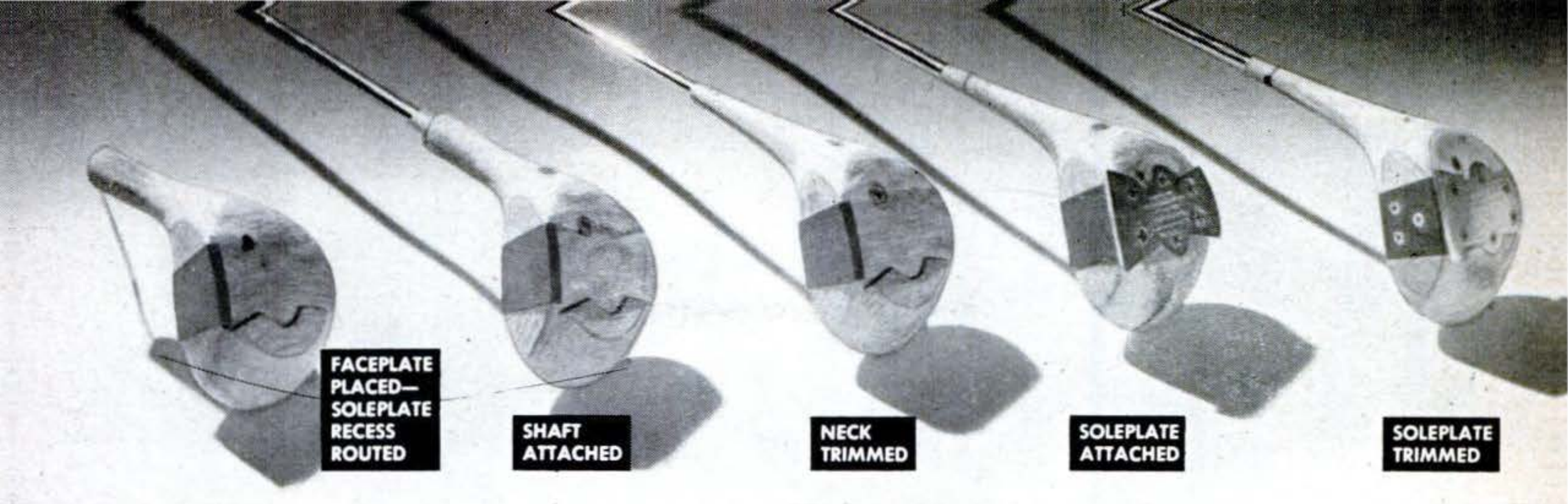


3 **Automatic copying lathes** are used to turn roughly sawed persimmon blocks down to the final club-head shape. A steel master model, at left, rotates against a wheel, and moves the entire framework holding it and the block into or away from revolving cutters.

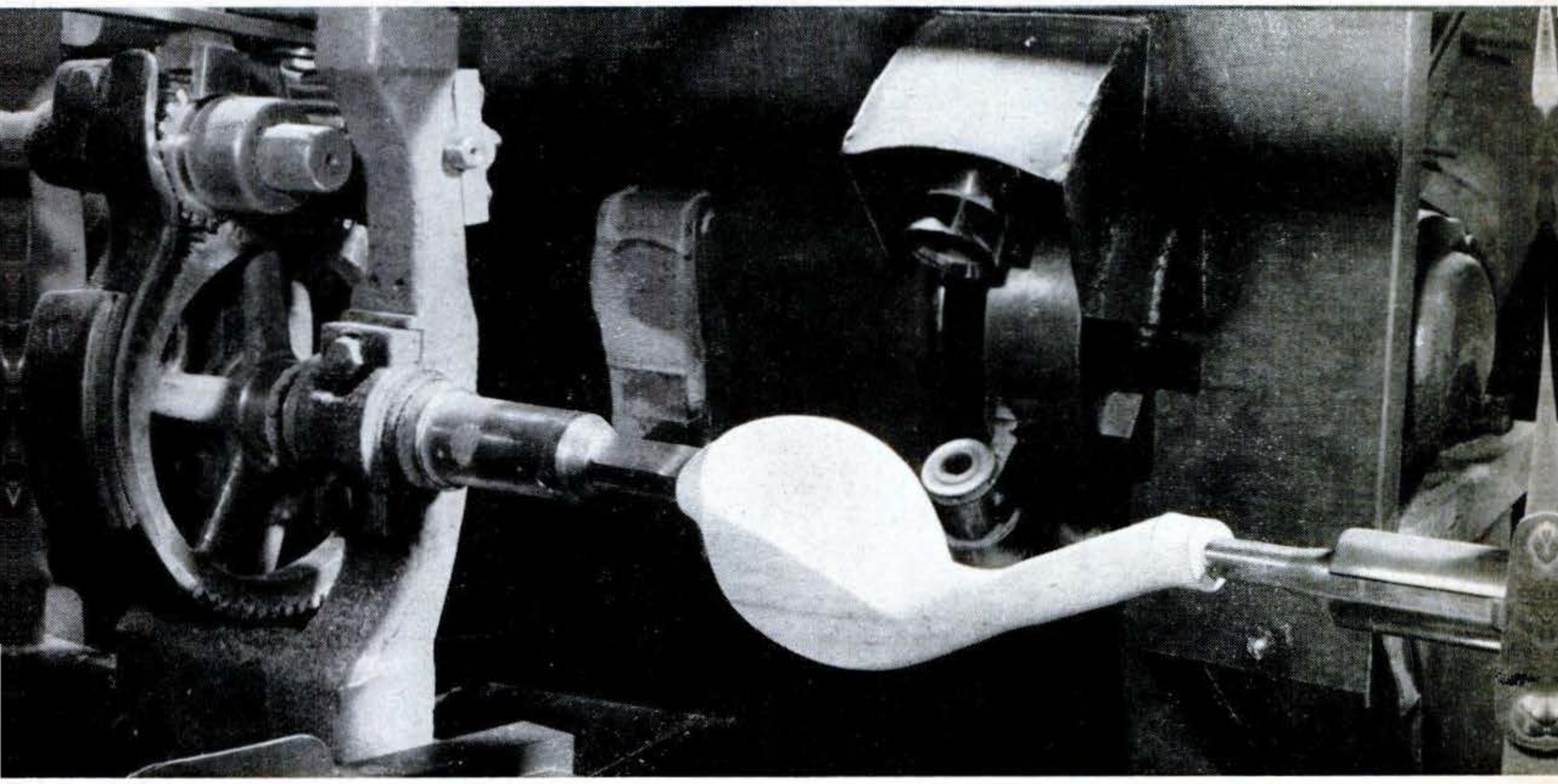
5 **Routers,** guided by followers in templates, are used to rout out depressions in face and bottom of club head to take plastic face plate, which is glued into place, and metal sole plate, which is screwed into place. In photo below, bottom of club head is being routed.

6 **Electric induction furnaces,** like the one below, dry the plastic glue used to attach the wood head to its steel shaft. This is called "hanging the head." The induction coil, center, dries the glue in 15 seconds to form a strong, waterproof bond.





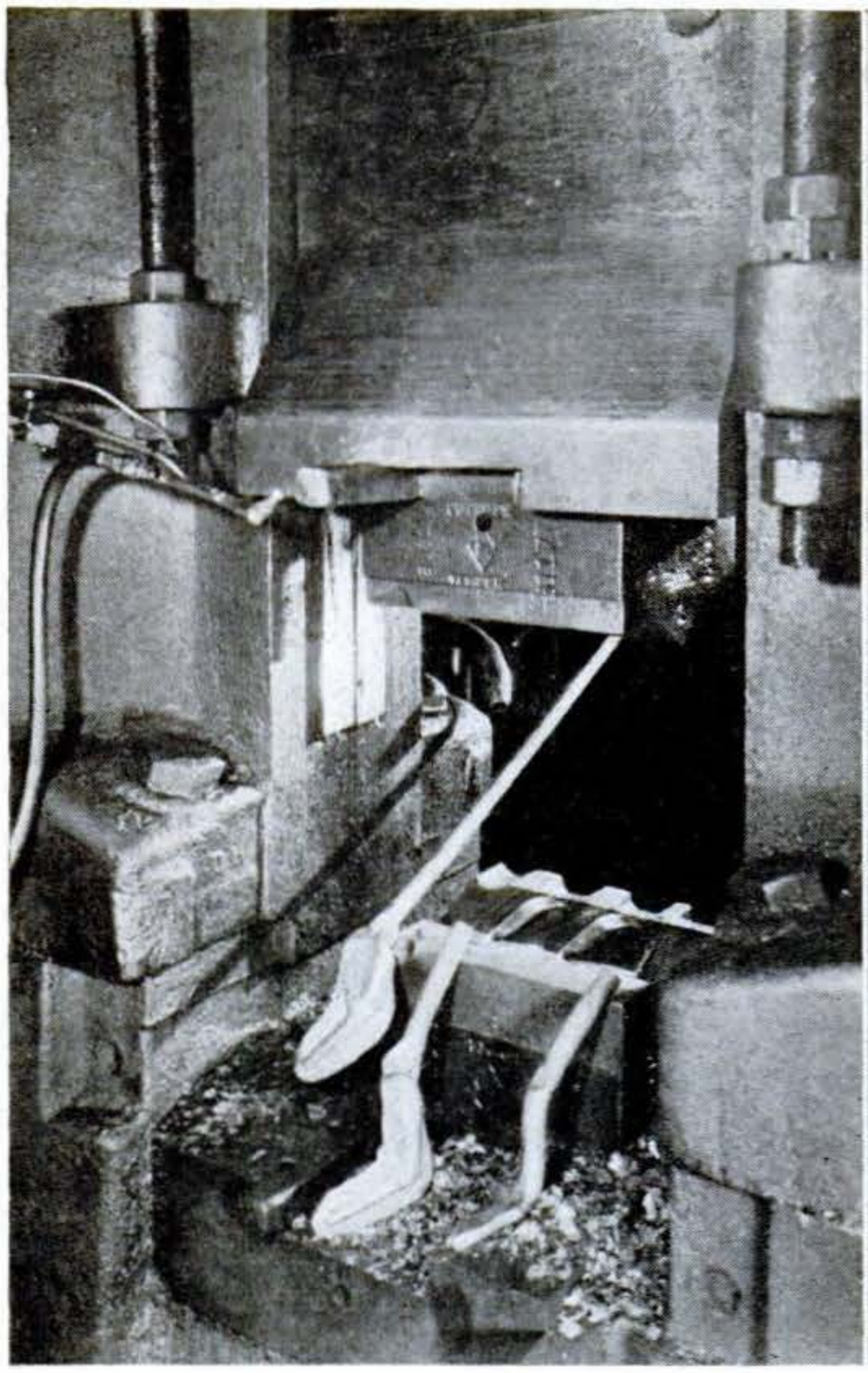
ing (extreme right). Decorative whipping cord is then wound around "hosel," or neck of head, trademark is stamped on, and club head is lacquered and given final buffing.

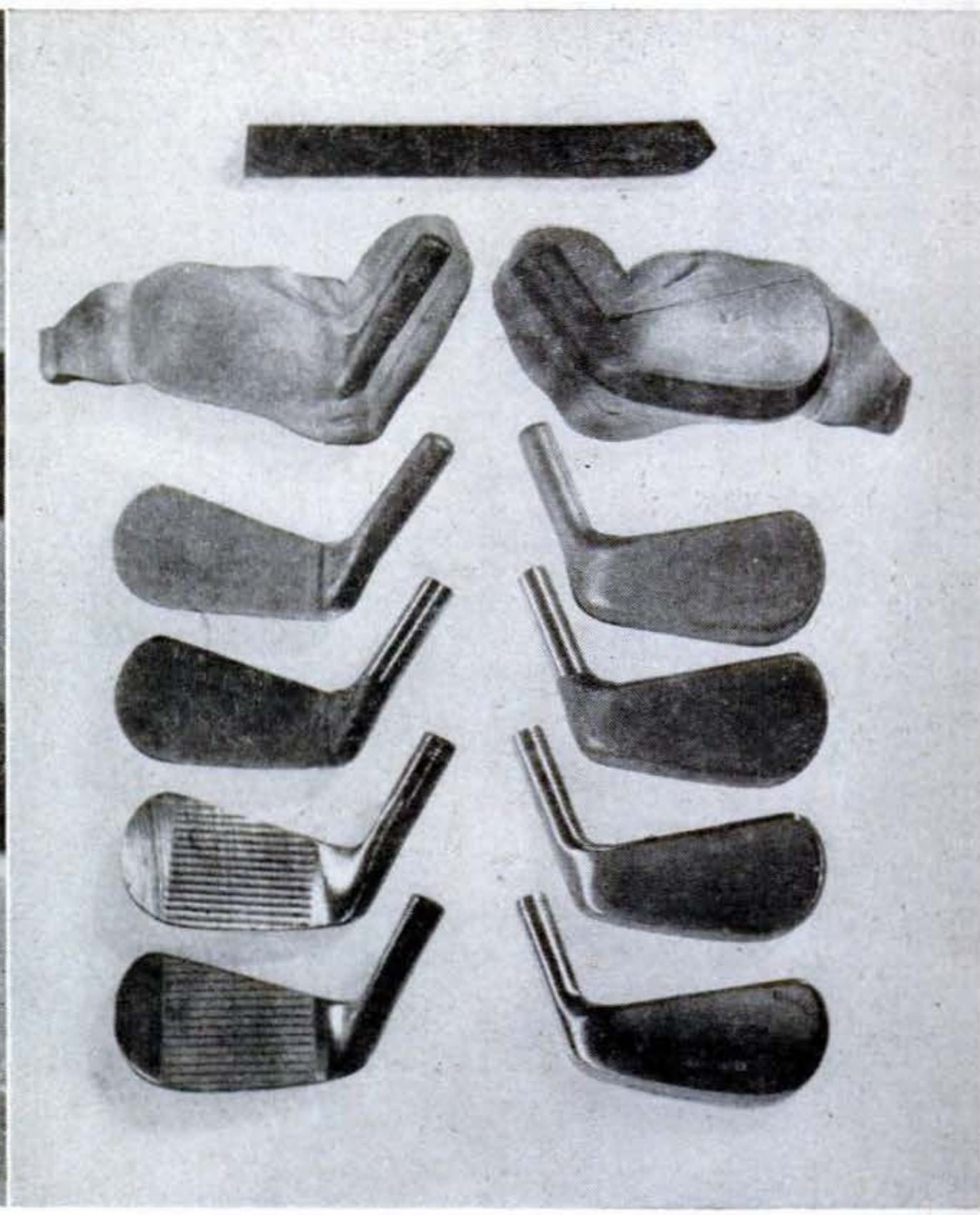


4 When club head has been turned to shape, lathe automatically stops. Two of the revolving cup-shaped cutters can be seen in the background behind the head. At the left is the live center that turns the persimmon block; at right is the lathe's dead center.

7 After the club is carefully weighed, a lead slug is pressed into a recess drilled in bottom of the head, directly in back of the face plate, to bring the club up to the desired weight. Eighteen different sizes of weights are used, ranging from ⅜ oz. to 2½ oz.

8 Matched woods are tested on special scale for proper "swing weight"—balance between length and weight. This must be same for all clubs in a set, though actual weights vary, so they have same "feel." If balance is off, lead is added or removed. [*Continued on next page*]

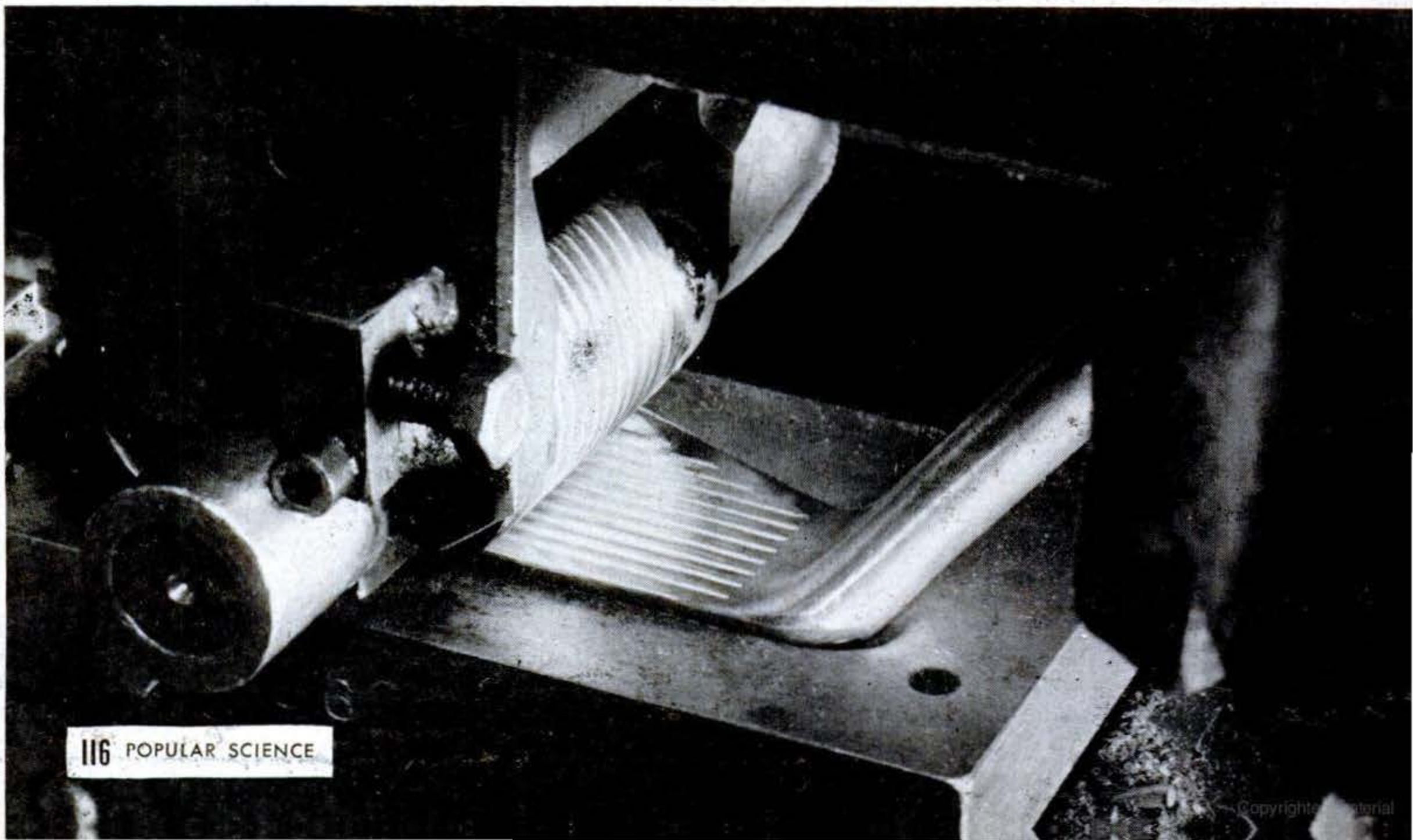




9 **An "iron" head** starts out as a length of steel rod, which is heated in an oil-fired furnace and then forged to the desired shape by a large drop hammer (above).

10 **The steel rod,** at top above, progresses through five basic steps before it becomes the head of an iron club. The front side is shown at the left, and the back side at the right.

12 **Stamping and marking** come next. Here, score marks are being rolled into the club face. Grooves, according to U. S. Golf Association specifications, can be no wider than .035 in., no deeper than half their width, and no closer together than three times their width. This makes sure that about the same amount of "ball control" will be built into all clubs.



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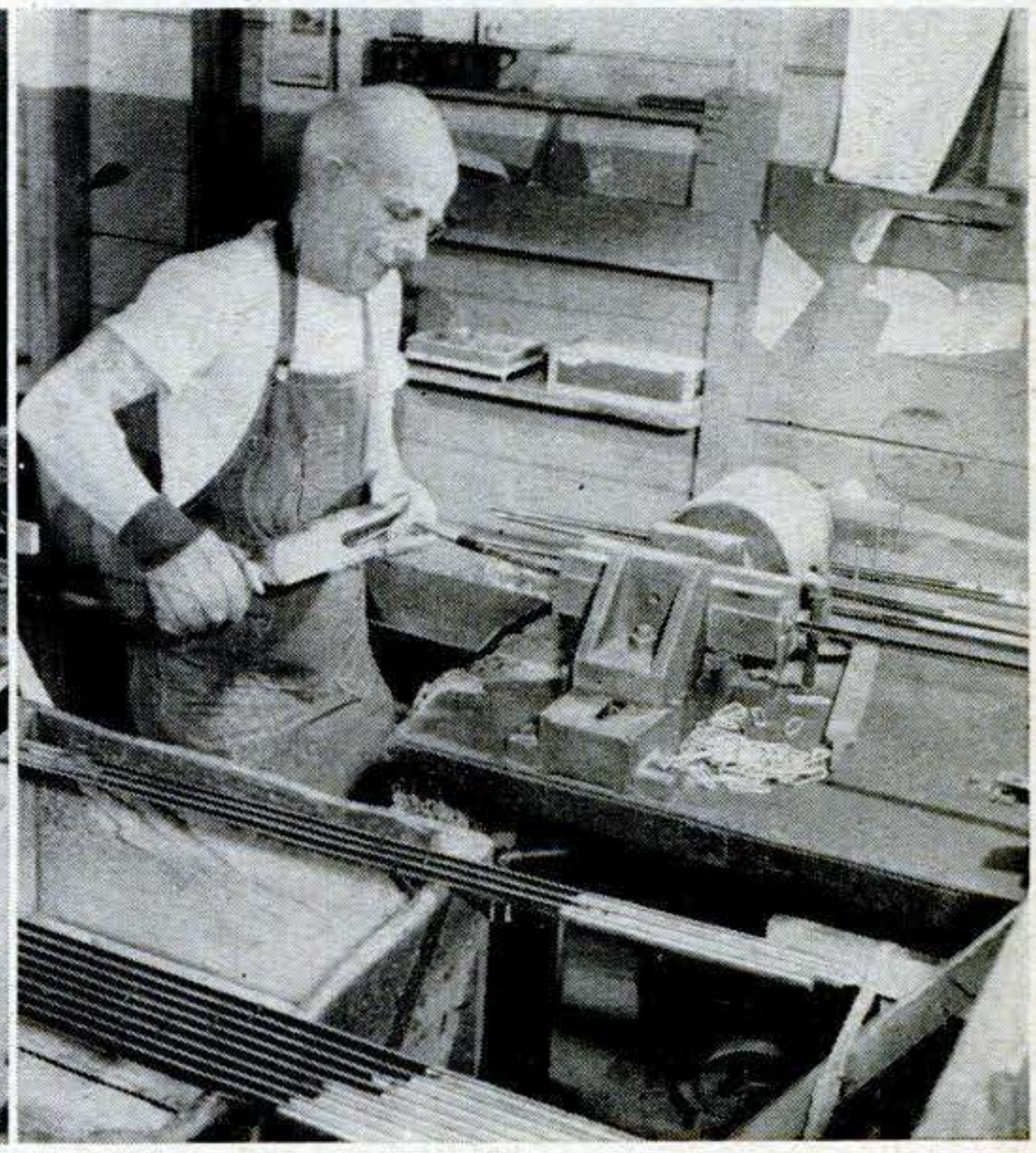
11 **Multi-headed machine** drills, reams, and threads the "hosels," or necks, of the heads. Before this, heads are annealed, tumbled to remove any scale, and trimmed in a punch press to remove excess metal, or flash. They are then rough-ground and finally placed in a centerless grinder that automatically grinds the neck to the specified diameter.

13 **Finished heads** are then carefully inspected and segregated by weight into sets. From this point on, matched heads travel along together, finally forming a matched set of irons.

14 **Iron head** finally is screwed onto tapered shaft. The thread, a Spalding patent, is left-handed so every blow during play causes threaded joint to tighten rather than loosen. END



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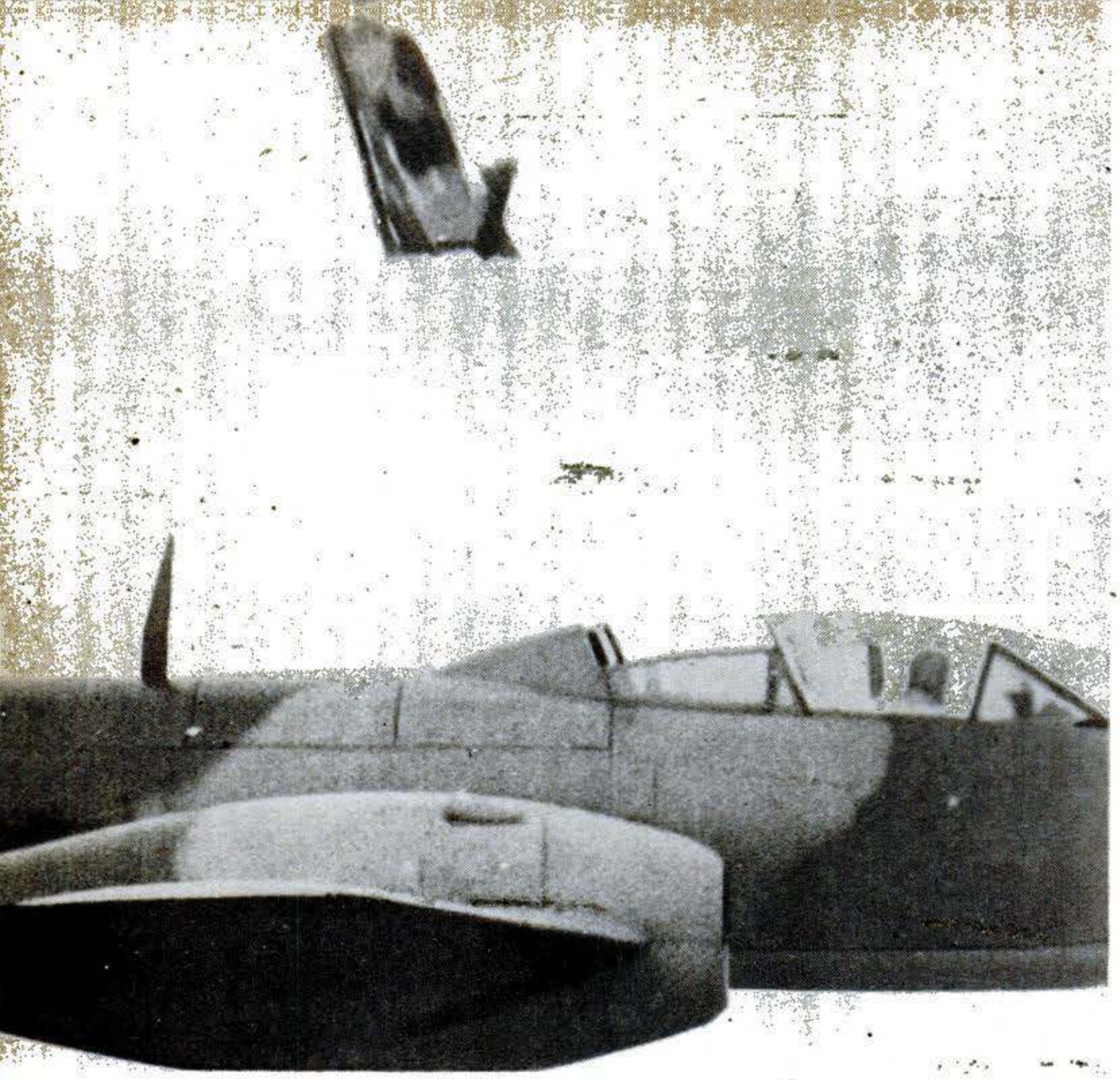


Photo Shows Flier Shooting from Jet

HE's on his way up so he can come down. One of the first pictures of an airman actually being shot to safety from a jet plane (left) shows an RAF flier just after he and his seat have left the plane.

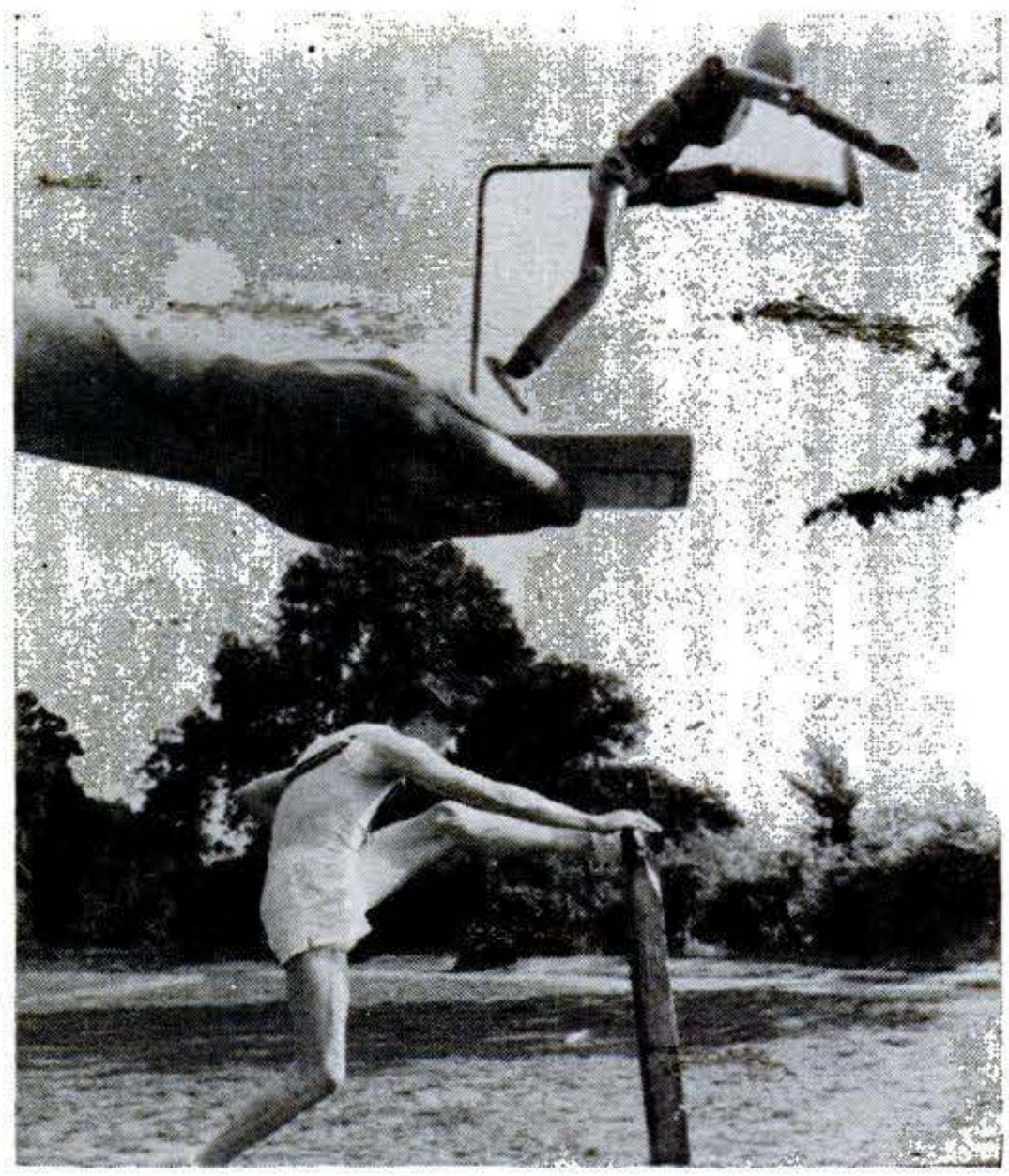
A few seconds after this photograph was snapped, he was automatically separated from the seat, his parachute opened, and he floated to the ground. British equipment works much like U. S. Air Force ejector seats—all the flier has to do is pull down the blind that will protect his face from the violent slipstream. This automatically fires him and the seat clear of the high-speed plane.

Disposable Mask Supplies Oxygen

PAPER, plastic, and elastic tape make a new kind of oxygen mask that is meant to be used only once, like a paper drinking cup. It comes in a small envelope and is thrown away after use. The paper mask has elastic straps so that it fits anyone. Inlet tube (arrow) and bag are plastic. Scott Aviation Corp., Lancaster, N. Y., makes it.

Puppet Trains British Runners

A TINY mechanical man is teaching British track stars how to swing their legs. "His Nibs" is a puppet of the type artists model from. Coach Geoffrey Dyson restrung it so that it had greater flexibility in bending sideways, forwards, and backwards, and now uses it to train runners and jumpers of the Amateur Athletic Association.



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The Little Toy Planes Are in the Navy Now

But the game that's played with these plastic miniatures is a serious one: Identification—*friend or foe?*

TOY factories are now turning out plastic planes to help Navy men identify friendly—and not-so-friendly—aircraft. They're made of plastic because that's the easiest way to mass-produce them.

The models are toys only in size. Representing actual American, British, and Russian planes, they are accurate right down to the tiniest fraction of an inch—except, of course, that they have no moving parts.

The tiny planes start out as drawings in the Special Devices Section of the Office of Naval Research at Sands Point, Long Island. Sometimes the toy factories work directly from the drawings alone. But in some cases the drawings are supplemented by hand-carved basswood models for the men in the factories to follow.

If the factory is to work from the drawings alone, expert patternmakers step in to create the miniature in pieces—fuselage, wings, engines, stabilizers, and control surfaces are all separately carved.

To make the dies that will actually form

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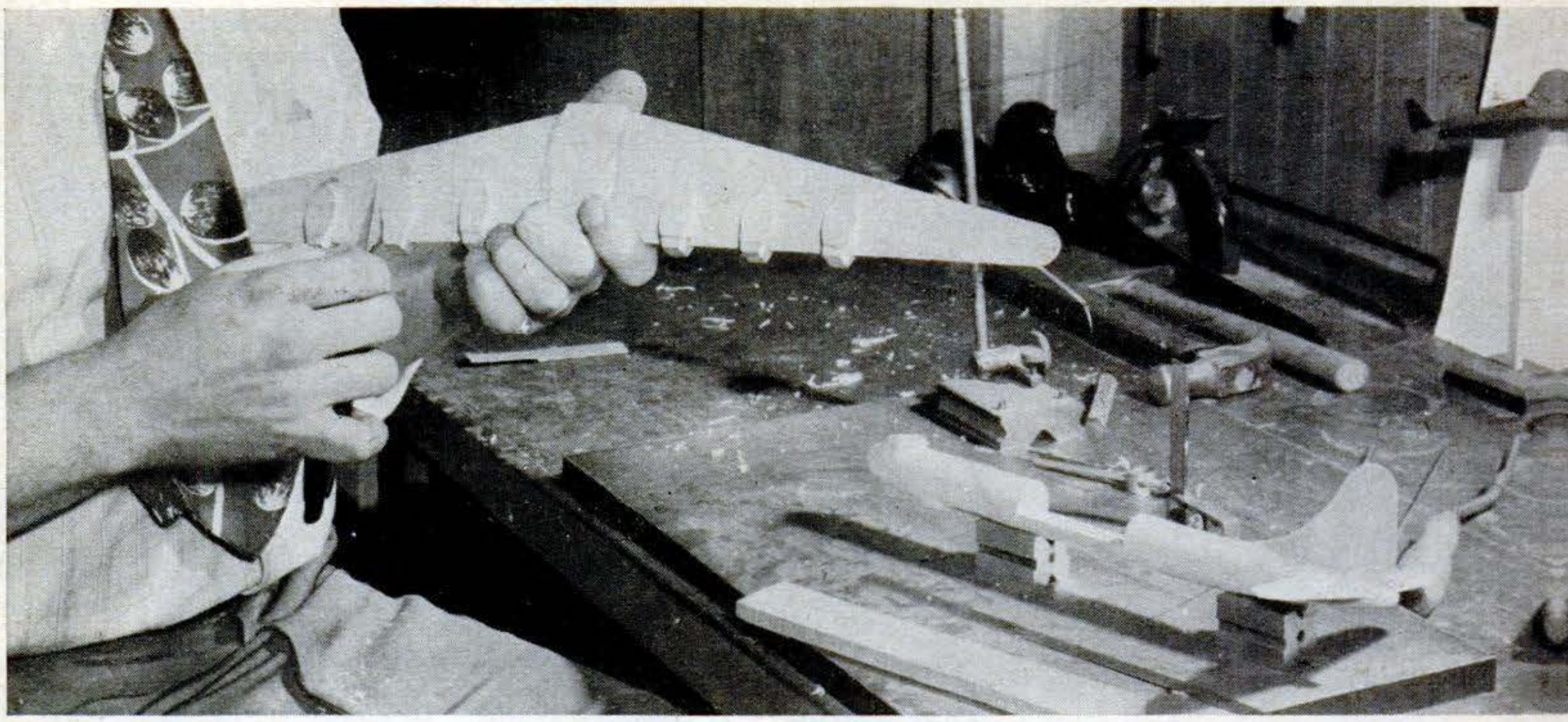
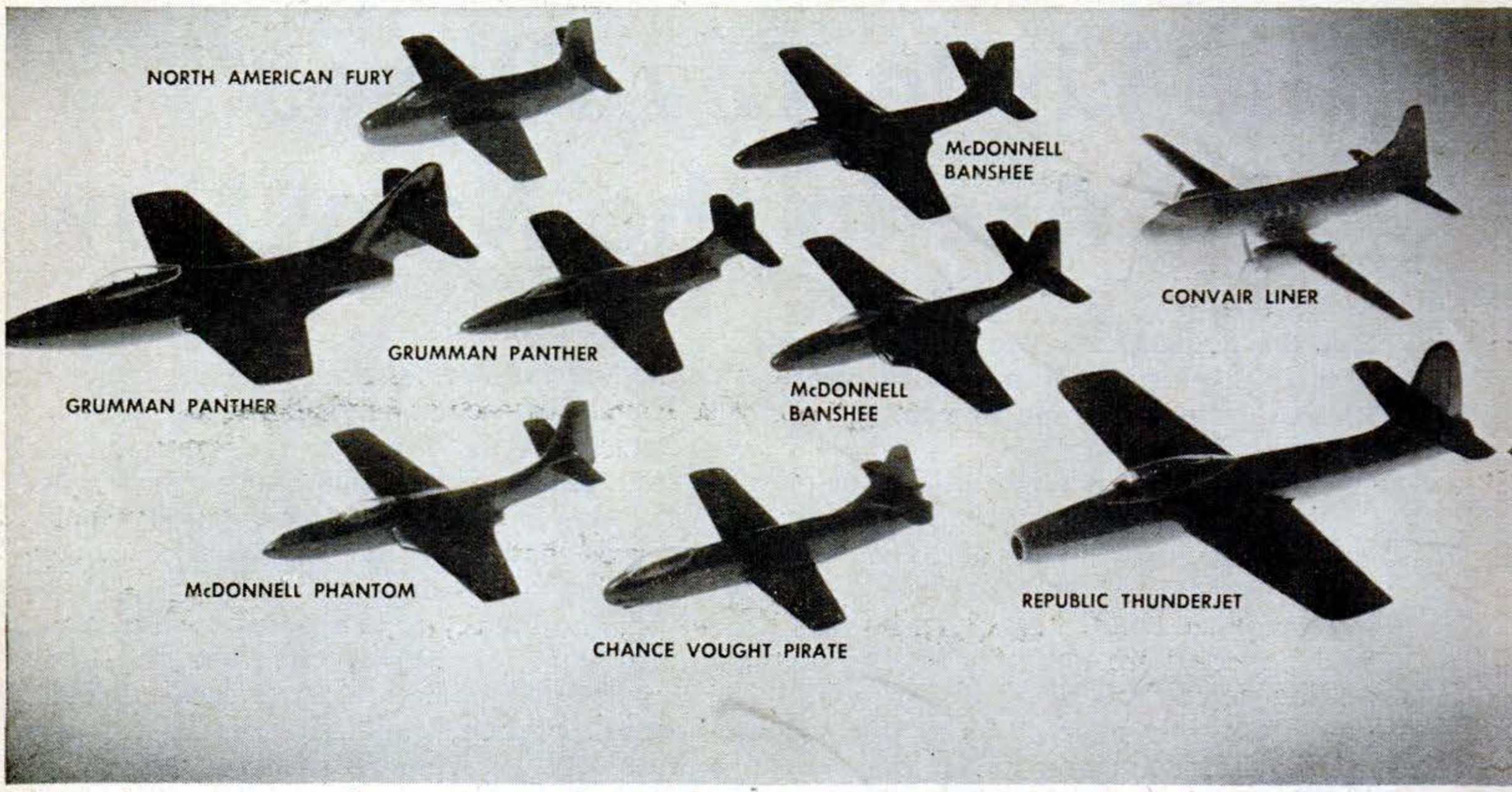


Making a wood pattern is first step in process of producing plastic planes. Here a workman fashions wing of a B-36 Superbomber, including nacelles on trailing edge. Fuselage, already carved, is on bench. It contains a cut-out for wing. Two scales are used—fighters are made on a ratio of 1 to 72, and big planes, like bombers, only half that relative size, or 1 to 144.

the models from plastic, every detail in each of these parts is then hollowed out in metal in halves. Then the two halves are combined in one master die.

After the dies are polished, they are clamped together and inserted into big injection-molding machines. Then cellulose acetate is forced into the molds under hydraulic pressure. When the plastic has set, all that remains is to trim off the rough burrs and glue the parts together. Some models get special paint jobs. But most are dull blue or aluminum gray, these colors being included in the plastic itself.

Coming off production lines by the thousands, the tiny models are being used to teach aircraft recognition at Naval training stations and on board ships headed for foreign waters—where these child's toys are helping to do a man's job. END



Planes shown on preceding page are identified above. How's your aircraft-spotting score?

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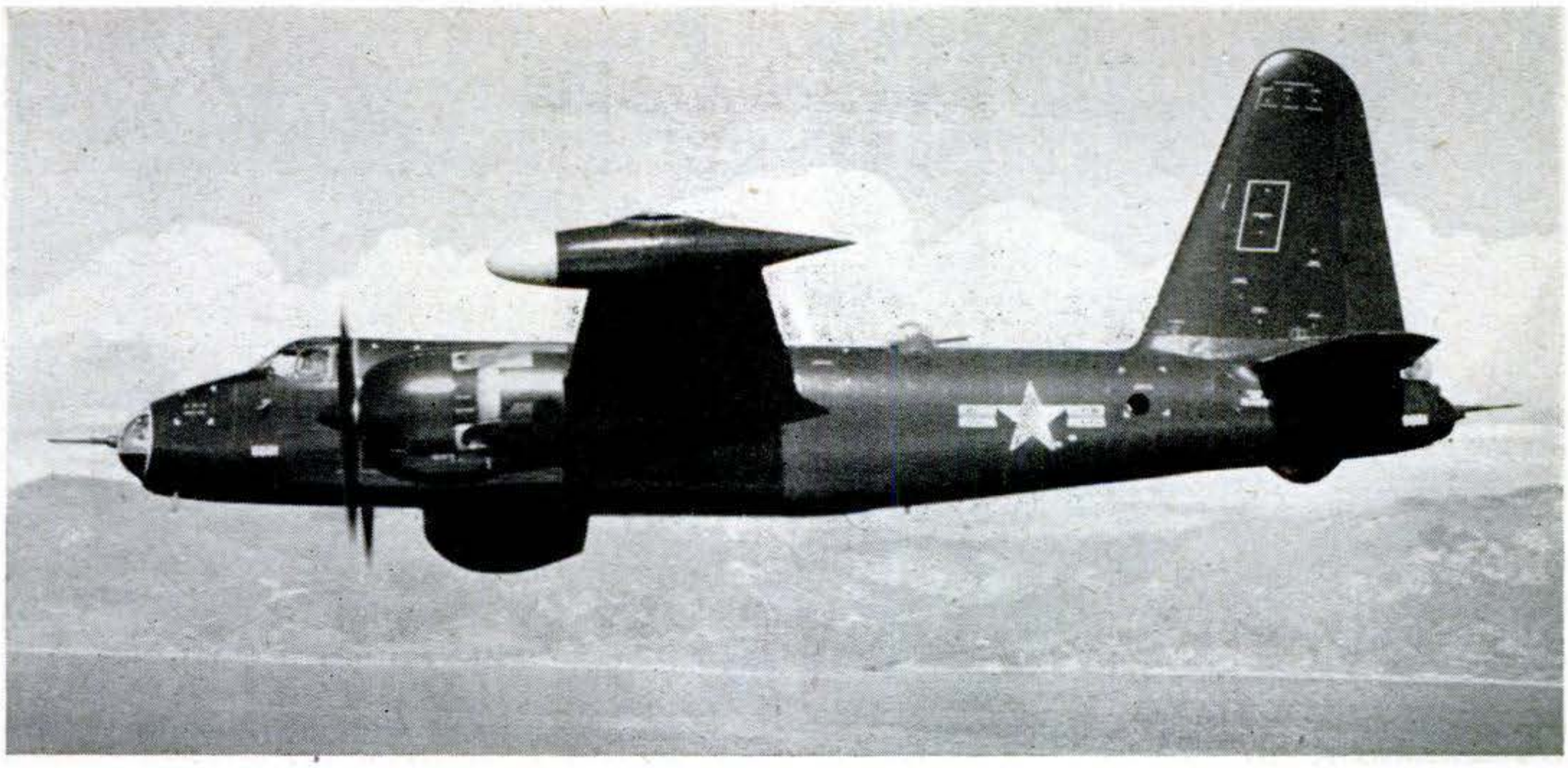
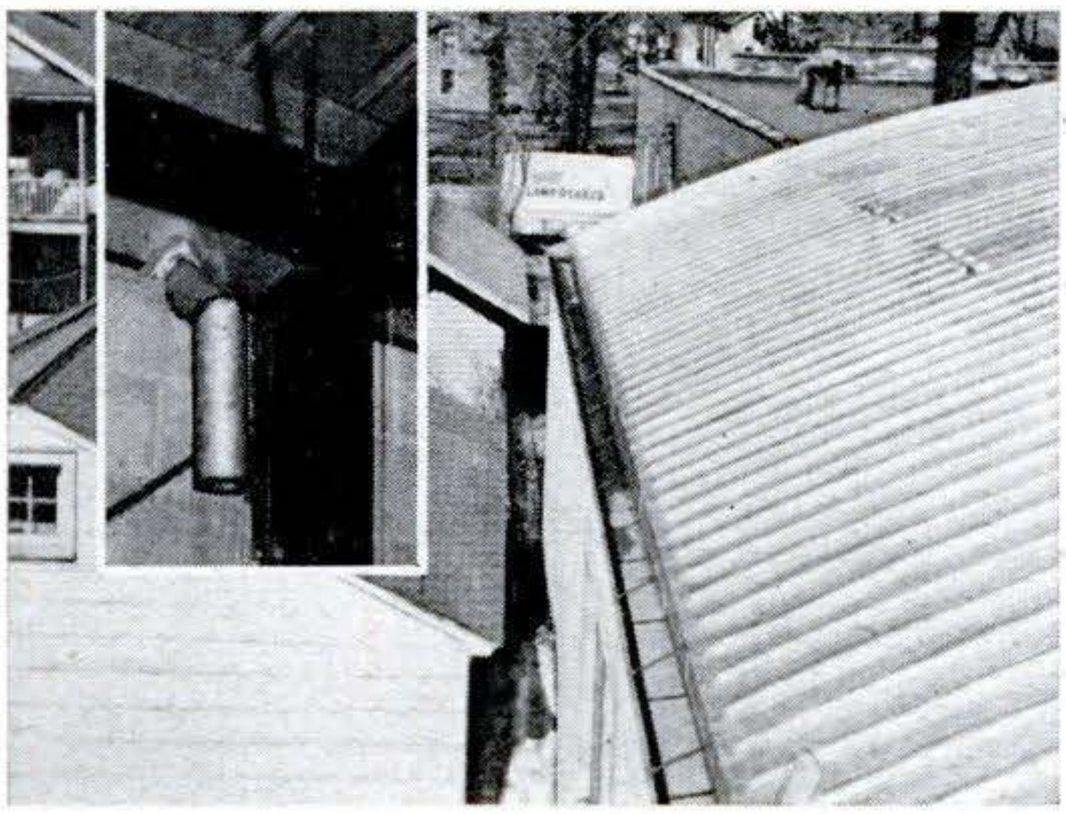


Anti-Sub Bomber Kills from Both Ends

A REAL killer is joining the Navy's anti-sub patrol. The latest model in the Lockheed P2V bomber series carries cannon in its new nose turret as well as guns in the tail turret. Extra radar and electronic devices help track down snorkel submarines. The P2V-5 is also being ordered by Great Britain and Australia for service with their fleets. Earlier versions of this plane are now in service in Korea, guarding UN forces against ocean-borne attack.

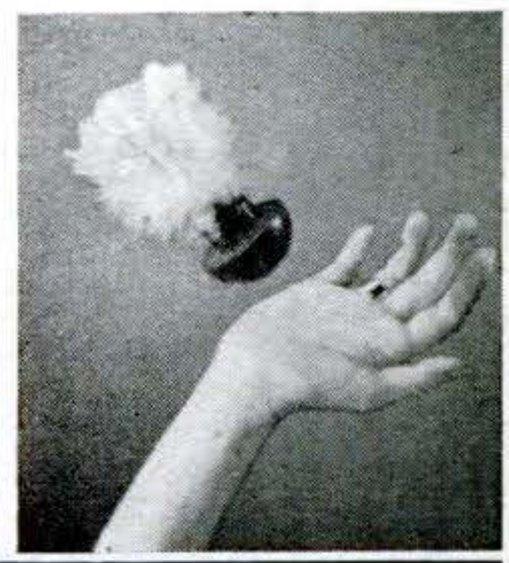
Hidden Gutters Built Inside Wall

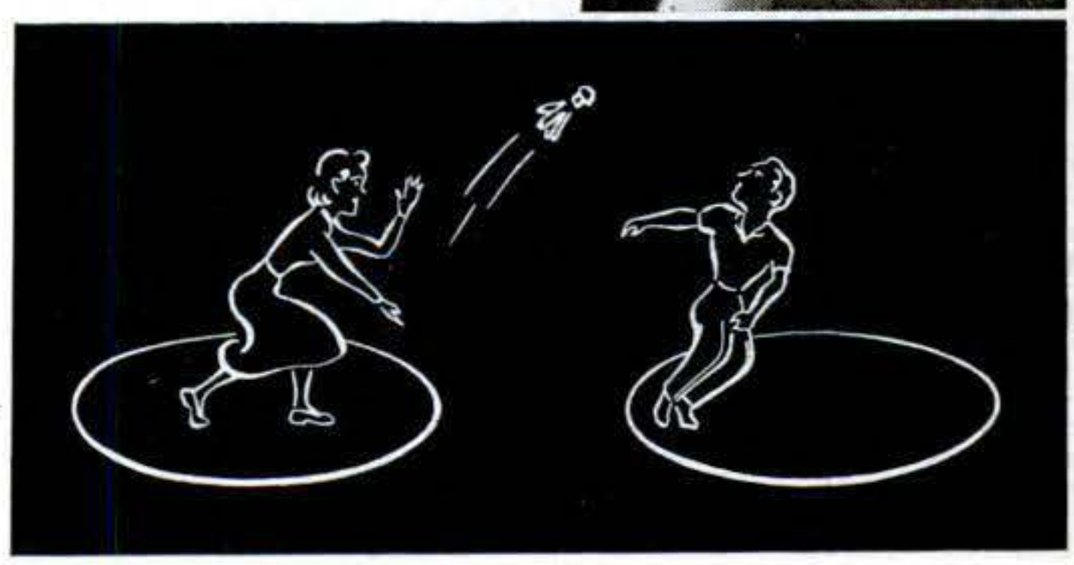


YOU can't see the gutters or drainpipes on this garage building—they're built right inside the wall. The gutter, set flush with the top of the cement-block wall, is exposed to the heat inside the building (inset) so that snow is melted quickly. The drains run down inside directly to the sewer. Butler Mfg. Co., Wausau, Wis., the builders, report this idea saved several hundred dollars.

"Bandy Ball" Game Needs No Court

A NEW version of badminton needs no equipment except the "bird," space, and any number of people. The feathered rubber ball (right) is bare-handed back and forth between areas marked on the ground (below). Points are scored against the side failing to return the ball. W. J. Ruscoe Co., Akron, makes it.





Welding Paste Masks Adjoining Areas

A NEW paste compound called Eutect-Mask protects adjoining metal surfaces from welding heat, flames, and spatter. After a welding job is finished, the dried residue can be easily scraped off. Eutectic Welding Alloys Corp., N. Y. C., makes it.

Melted Rosin Stiffens Metal Tubing

METAL tubing used for table legs and similar jobs sometimes lacks rigidity. It can be stiffened by pouring in melted rosin and letting it harden. In some cases, a cement mortar might also be used as a filler.—*Walter E. Burton, Akron, Ohio.*

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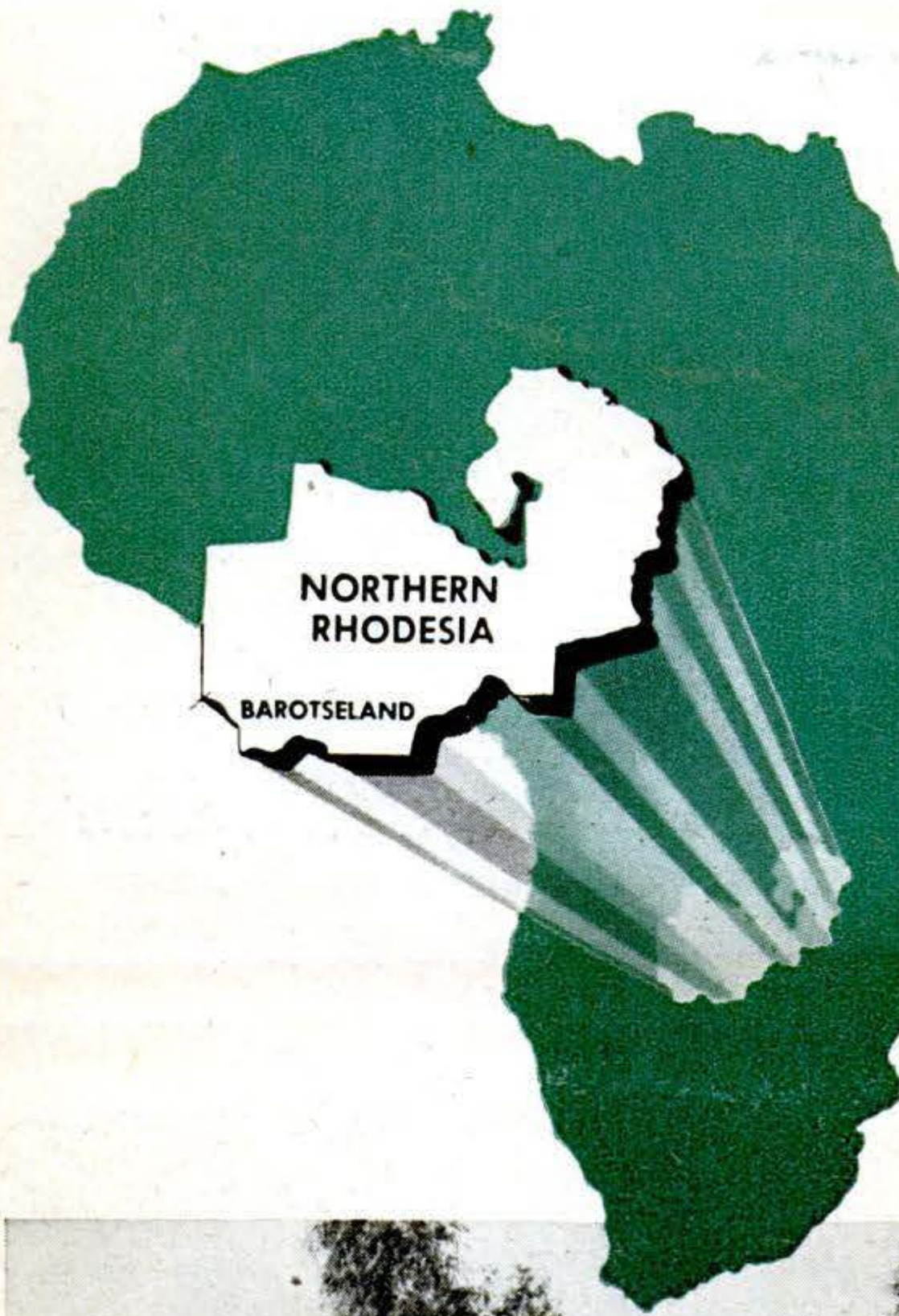
African Explorer Finds A Primitive "Pittsburgh"

PHOTOS BY ARTHUR MENEKEN



WHEN you need a new tool in Barotseland, high above Victoria Falls in deepest Africa, you can't shop around at the nearest hardware store. You walk to the ironmakers' village, a backwoods Pittsburgh called Makwanga, and watch native craftsmen turn crude iron ore into your ax or hoe. It takes all day, for you are back in the Iron Age, where simple tools are made the way man first learned how 3,000 years ago.

An American explorer, Margaret Hubbard, brought back the story from a recent expedition into Northern Rhodesia.

Lumps of rich bog ore, gathered from mud holes near the village, are dumped into a shallow trench, mixed with burning charcoal, and brought to a white heat with a bellows made from an otter skin attached to a clay tube. When the refined iron has trickled off and cooled to a soft blob, it is carried with tongs to an open-air smithy under the spreading mahogany trees. And there, with reheating to keep it malleable, it is hammered into the single hoe, ax, or spearhead that is the day's entire output of several craftsmen and apprentices.

Native ironworkers greet an American explorer, Margaret Hubbard, in the African village of Makwanga. They told her that the trade secrets of their guild had been handed down unchanged from an ancestral god, Sikwa, through many generations of masters and apprentices.

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1. A miner digs chunks of ore from a water hole and collects them in a reed basket. The ore is dried in the sun, carried to the village.

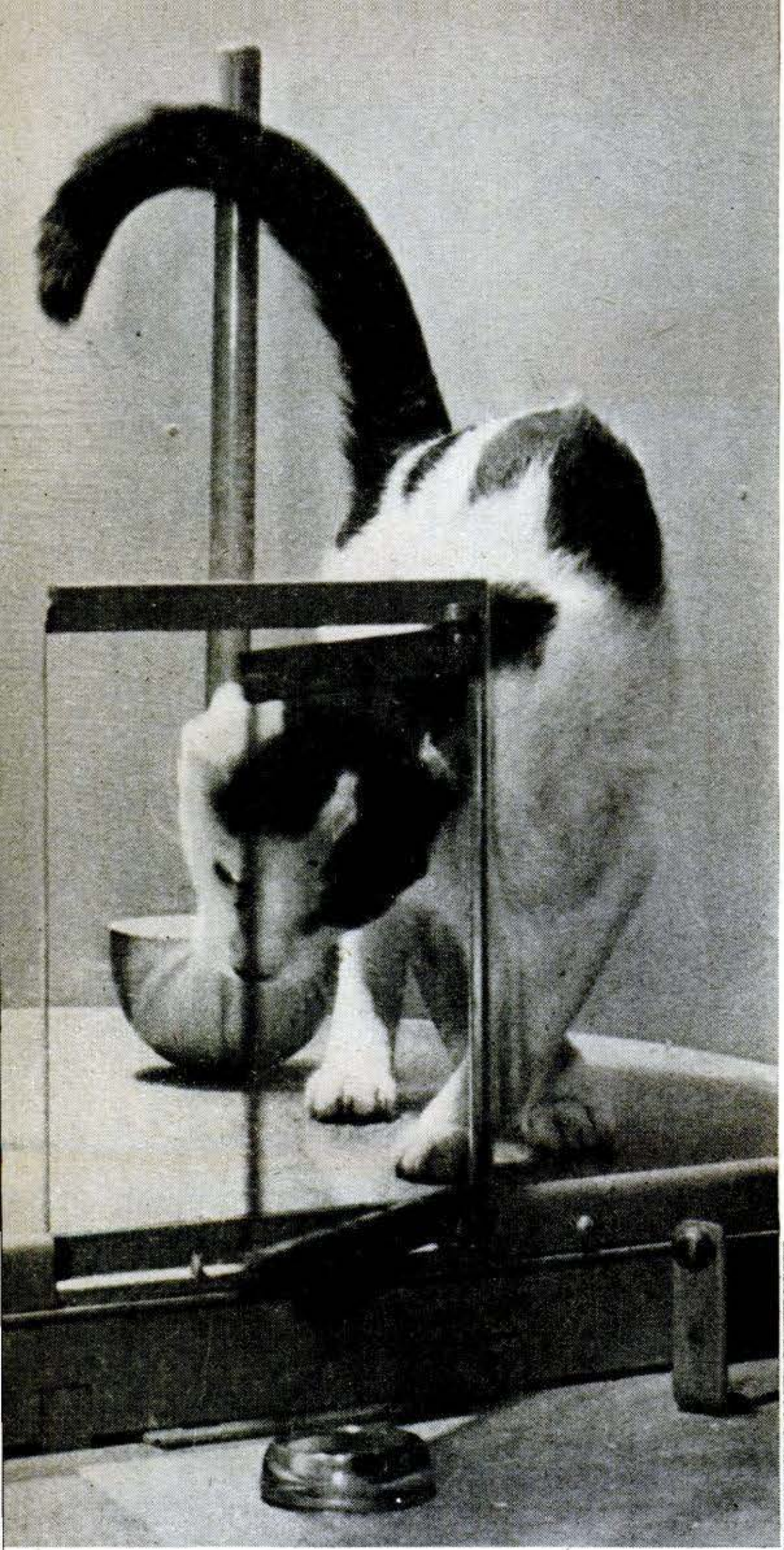
2. Chief of the ironworkers and a young apprentice pump the bellows at the smelting pit while mixing the ore with glowing charcoal.

3. Ready for forging, the blob of iron is carried to the smithy in tongs and reheated by another apprentice until it is malleable.

4. The master smith shapes the white-hot iron by pounding it with a hammer. Here he is ready to put the finishing touches on a hoe.

5. A customer proudly displays the hoe handles he has carved as he waits patiently for the smith to hammer out a blade for one of them.

6. Implements used by the ironmakers, traditional from the days of their ancestors, include these hammers, tongs, and other tools. END



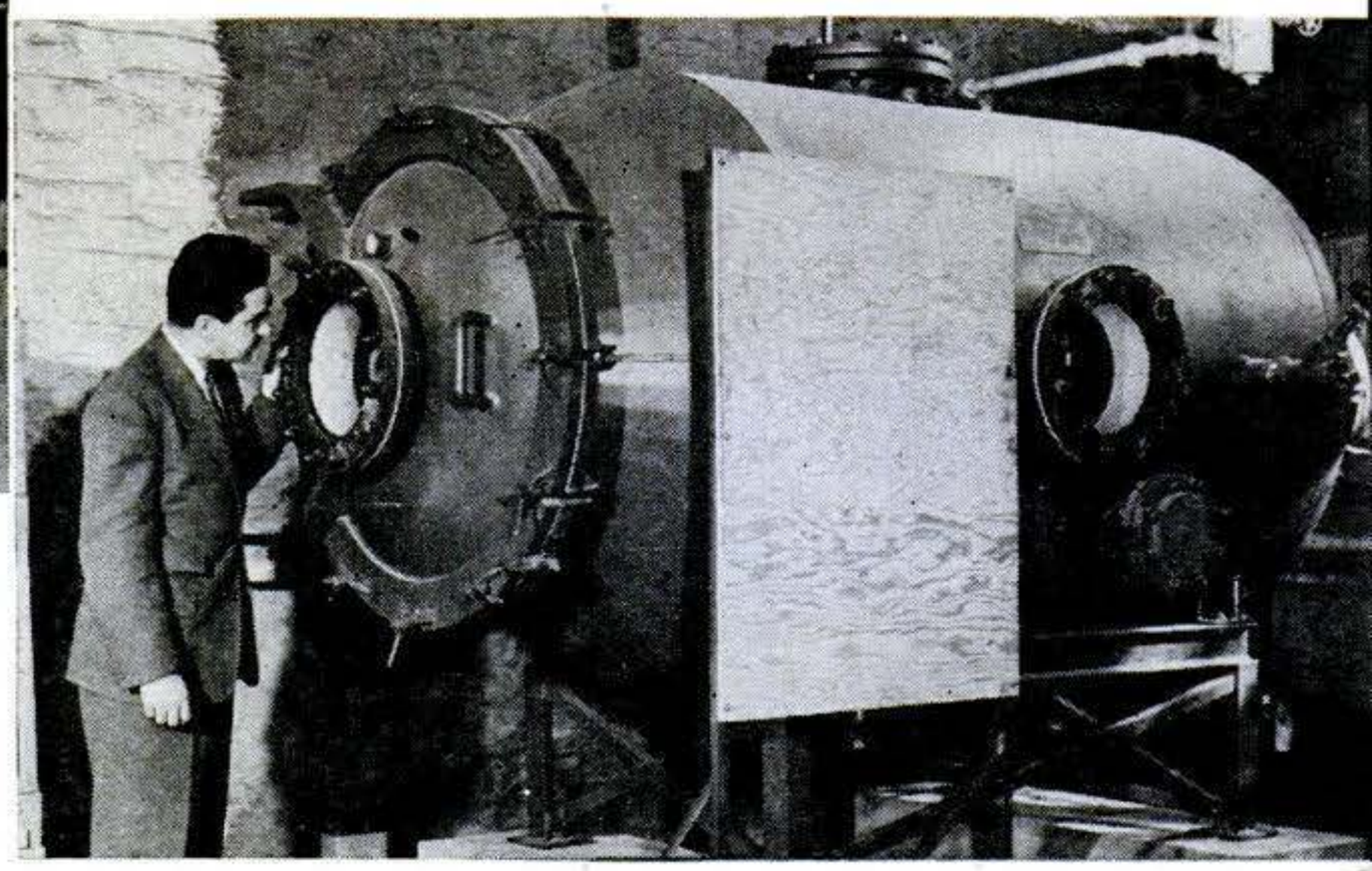
Cats Show How Air Affects Smartness

THIS cat is smart. By poking her nose through the glass door she gets some liver—and the scientists watching her get some information that may be very valuable to human beings.

The researchers are testing an old theory that feeblemindedness can be caused by a lack of oxygen at birth. They are using cats, rats, tests of skill like the door trick, and a decompression chamber.

Half a litter of newborn cats or rats is put in the decompression chamber and kept on short oxygen supply for 30 minutes. Then they are taken out. As they grow up, their ability to learn and to remember what they learn is compared with the abilities of their brothers and sisters who were not in the chamber. Some bright rats learn how to get through a complicated maze in five or six trials; the dumbest take about 75.

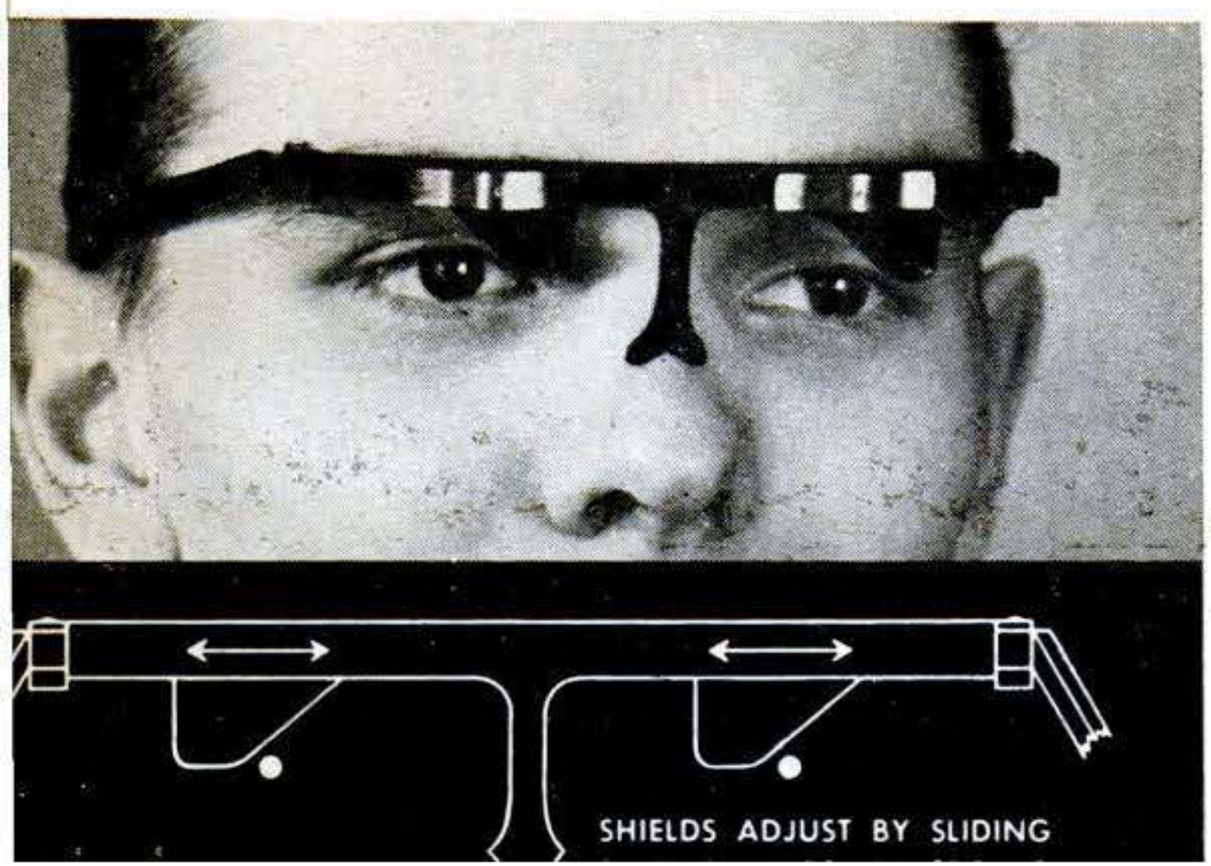
Research at Washington University's psychology laboratory, conducted by Dr. Marion E. Bunch and Gilbert W. Meier, thus far shows that rats who were denied normal oxygen right after birth *are* slower on difficult problems.



After flipping stick with her tail to unlock door, smart cat pushes it open with her nose to get at the liver in dish outside.

Half the animals in new litters get 30 minutes in this decompression chamber where the oxygen supply can be adjusted at will.

"Blinders" Cut Night Headlight Glare



Now they've taken the "blinders" off the horse and put them on the motorist. These eye shields for night driving give the wearer a clear view, yet if he lowers his head when a car approaches, the dark shields protect his eyes from headlight glare. To work properly, they have to be adjusted so they are the same distance apart as the eye pupils. Bruce Industries, Plantsville, Conn., makes them.

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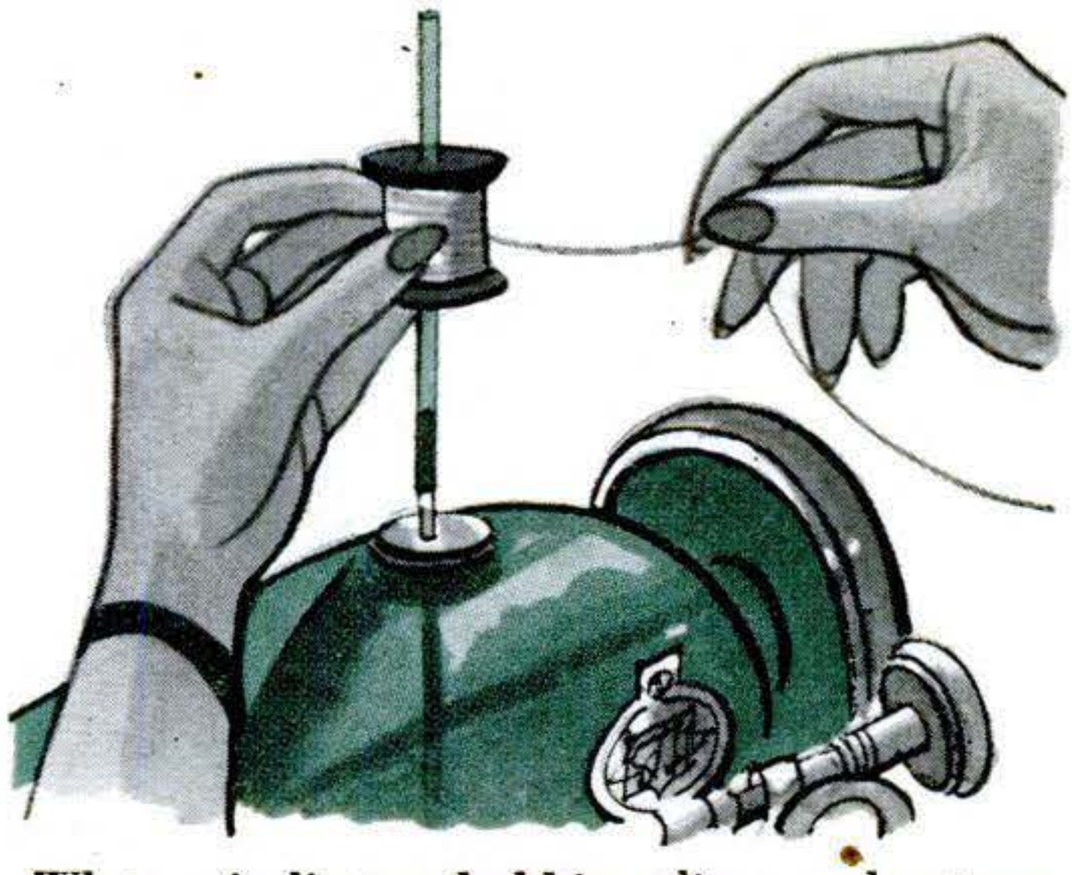
Keeping the Home Shipshape

When you leave home for a picnic, take along a jar of soapsuds and a jar of clean water. Sticky children and sooty fire tenders will be all set for a wash-up before eating.



When winding a bobbin, slip a soda straw over the spindle before putting on the spool. If the spool jumps up and down, it won't go high enough to jump off the top of the straw.

At beach and lake cottages, keep your sugar in a plastic-topped syrup pitcher. The sugar won't get lumpy or attract insects, and it pours easily from the spout provided.

Whenever screen doors are opened and closed, the hook clatters against the door, marring the finish. You can eliminate this by covering the hook with a drilled and slit cork.

To remove dog or cat hairs from upholstery, moisten a rubber sponge and rub it lightly over the surface. The hairs will form into little balls, easily and quickly brushed off.

Please turn the page for five more suggestions.

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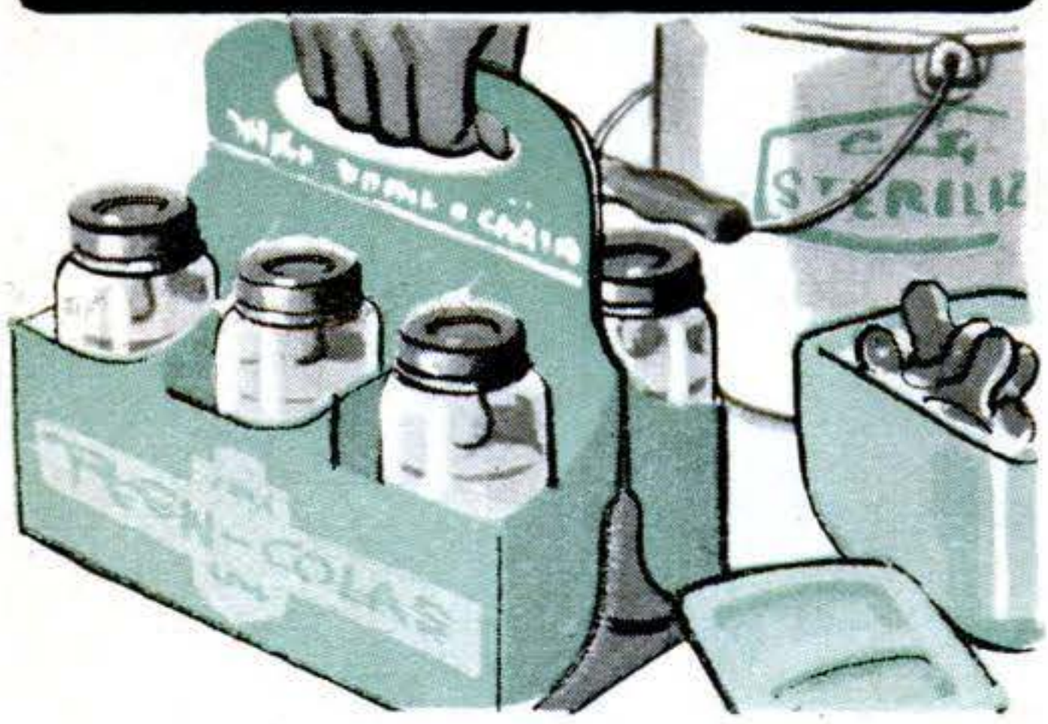
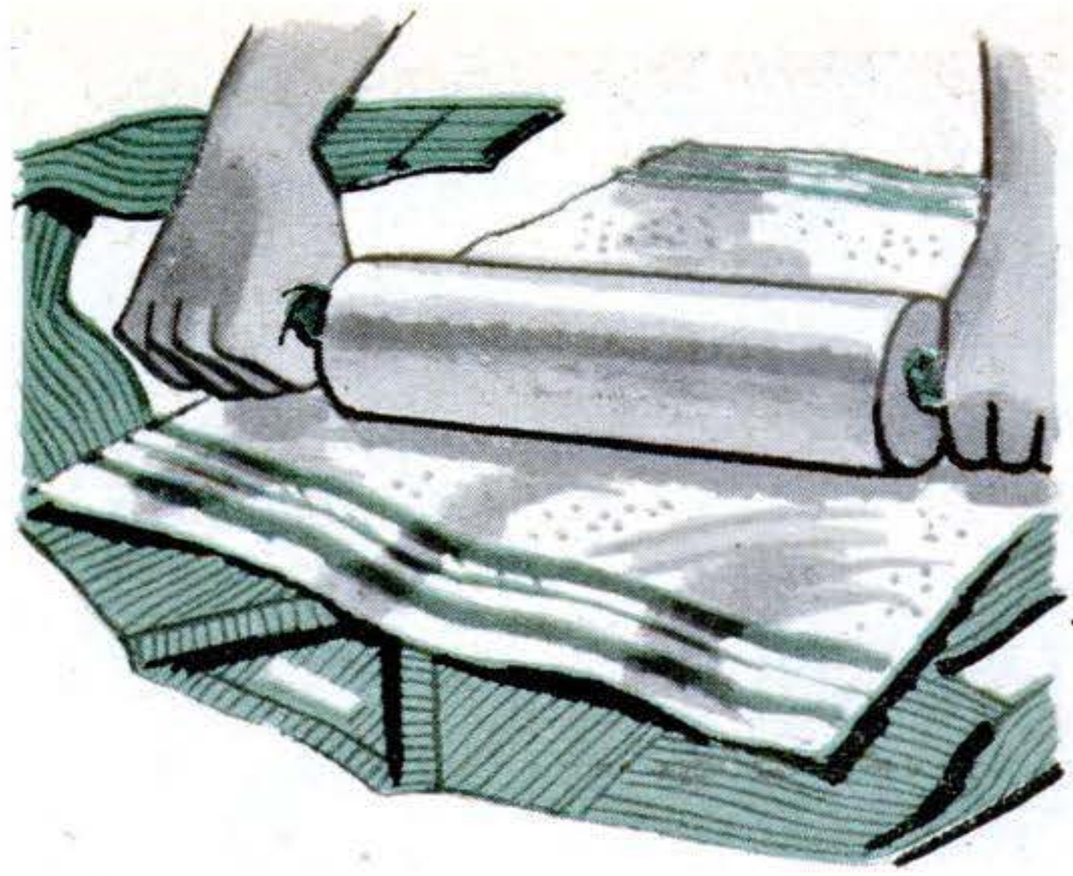
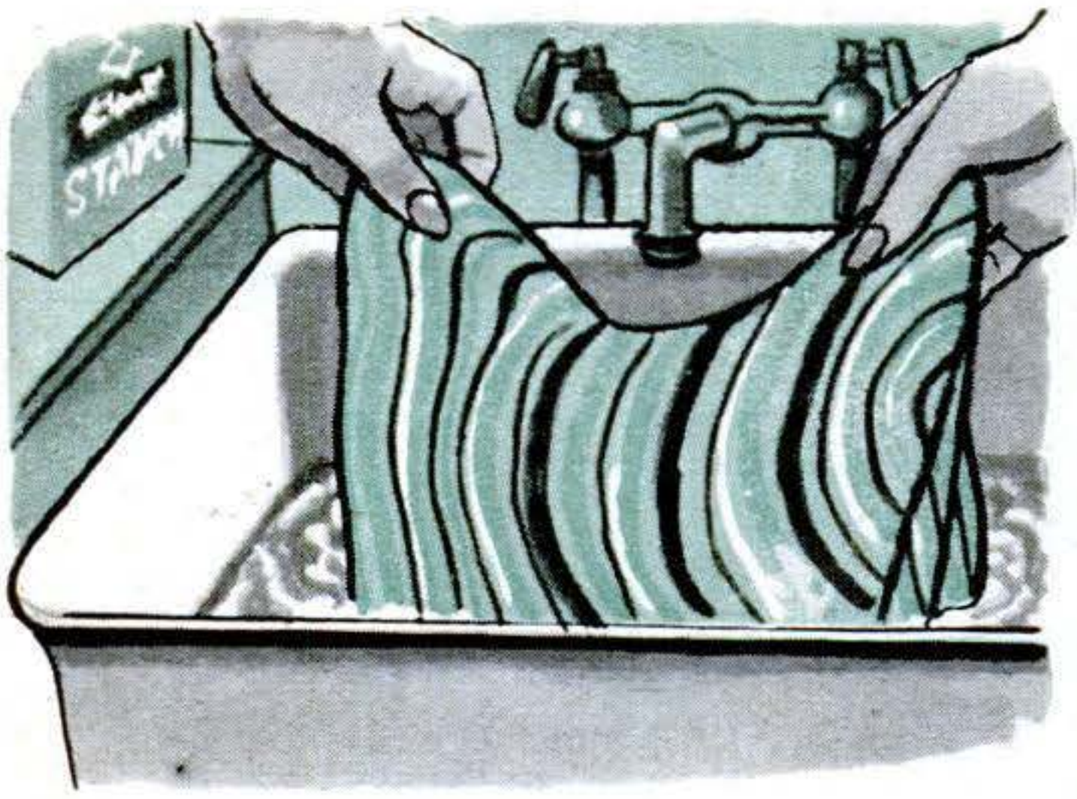
Keeping the Home Shipshape



A pop-bottle carrier is a handy container for baby bottles. Six bottles can be carried to the refrigerator at once, and the carton is easy to move to reach behind the bottles.



To speed sweater drying, lay the sweater between two heavy turkish towels on a flat surface and press out all water with a rolling pin. Replace towels as they become damp.



After washing rag rugs, dip them into a mild starch solution and wring out well. Lay flat on newspapers to dry, patting into shape. The starch gives them more body when dry.

Don't shake your dust mop. Lay your vacuum cleaner on the floor upside down, and draw the mop slowly back and forth over it. It'll draw out all the dust and fluff up the mop.

A leg rest like this one will make a garden chair more comfortable. Just nail two boards together at right angles and attach angle irons on each side to make the joint rigid.

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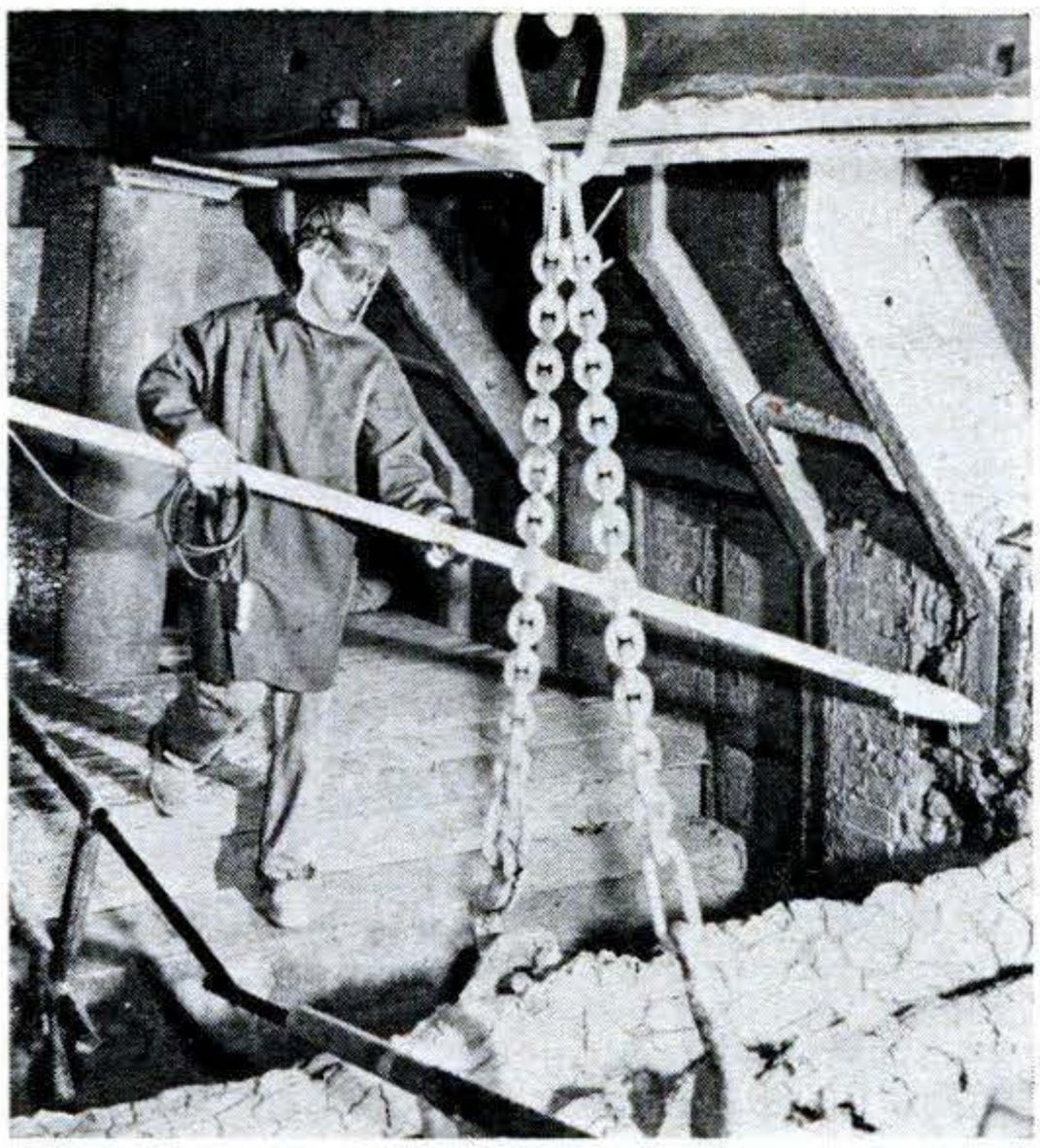
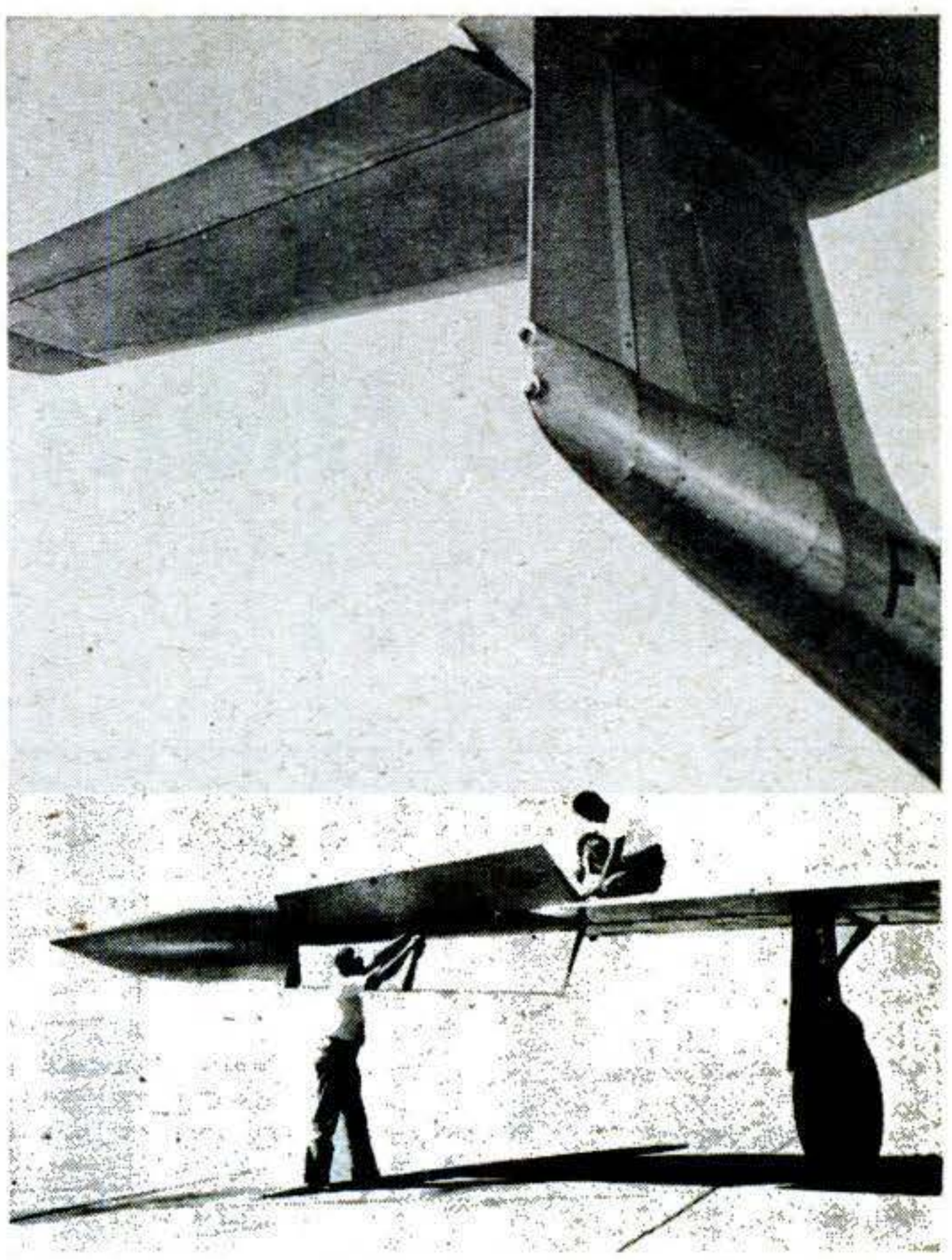


"Bazooka" Blast Unplugs Steel Furnace

STEELWORKERS now shoot out the clay plugs that hold the molten metal inside open-hearth furnaces. They use a long cardboard tube containing an explosive charge, similar to the Army's bazooka. With this device, already in use at Republic Steel, the worker can stand a safe distance away from the furnace—previously he had to burn out the plug with an oxygen lance and then run from the gushing steel.



Scorpion Combines Ailerons, Brakes

JAWLIKE "decelerons" on this Northrop Scorpion F-89 fighter-interceptor act as both ailerons and brakes. When the plane closes in on a target, its pilot opens these up-and-down flaps to reduce speed long enough to fire, then closes them and scoots off.

Chemical Shutter, Mirror Take 24,000,000 Photos a Minute

YOU can "stop" an explosion wave with this British camera. It takes 24,000,000 photos a minute with a Kerr cell. This chemical shutter contains a solution that can pass or block light as the voltage across it changes its ability to polarize light. Synchronized with this shutter is a many-faced mirror spinning 150,000 times a minute. The mirror sends individual exposures to film behind a series of lenses.

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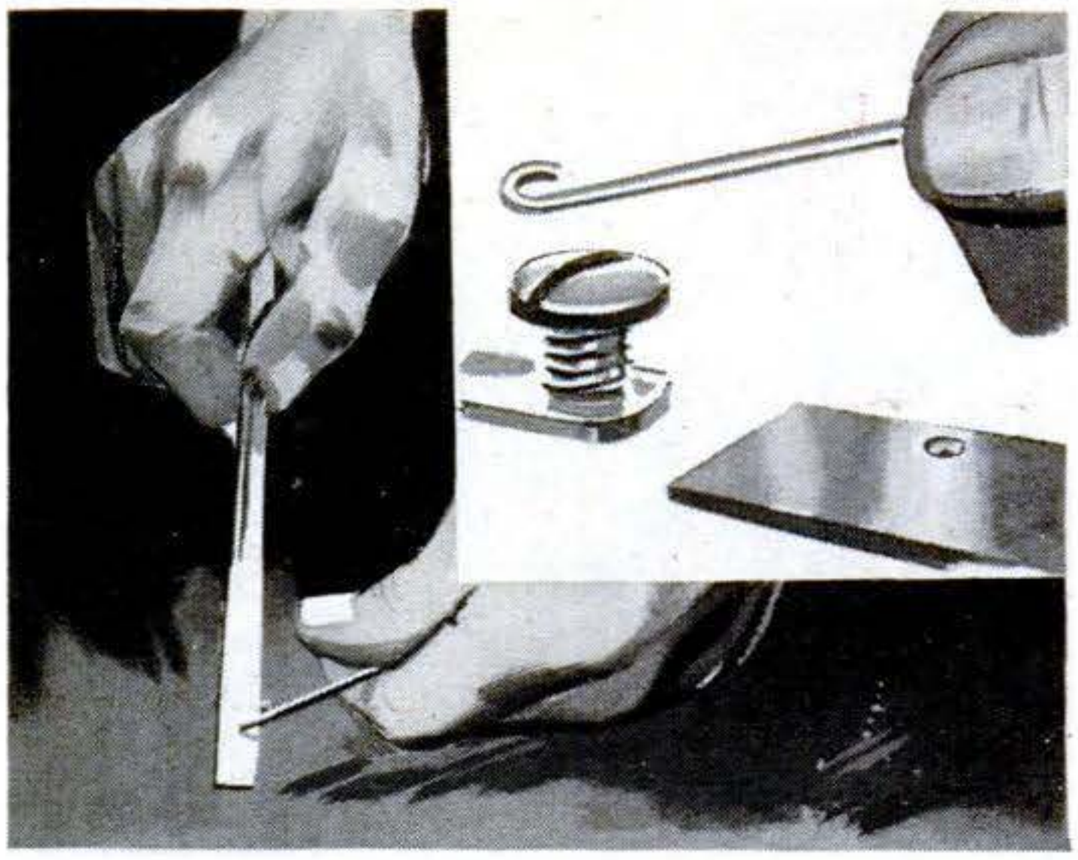
I'd like to see them make...

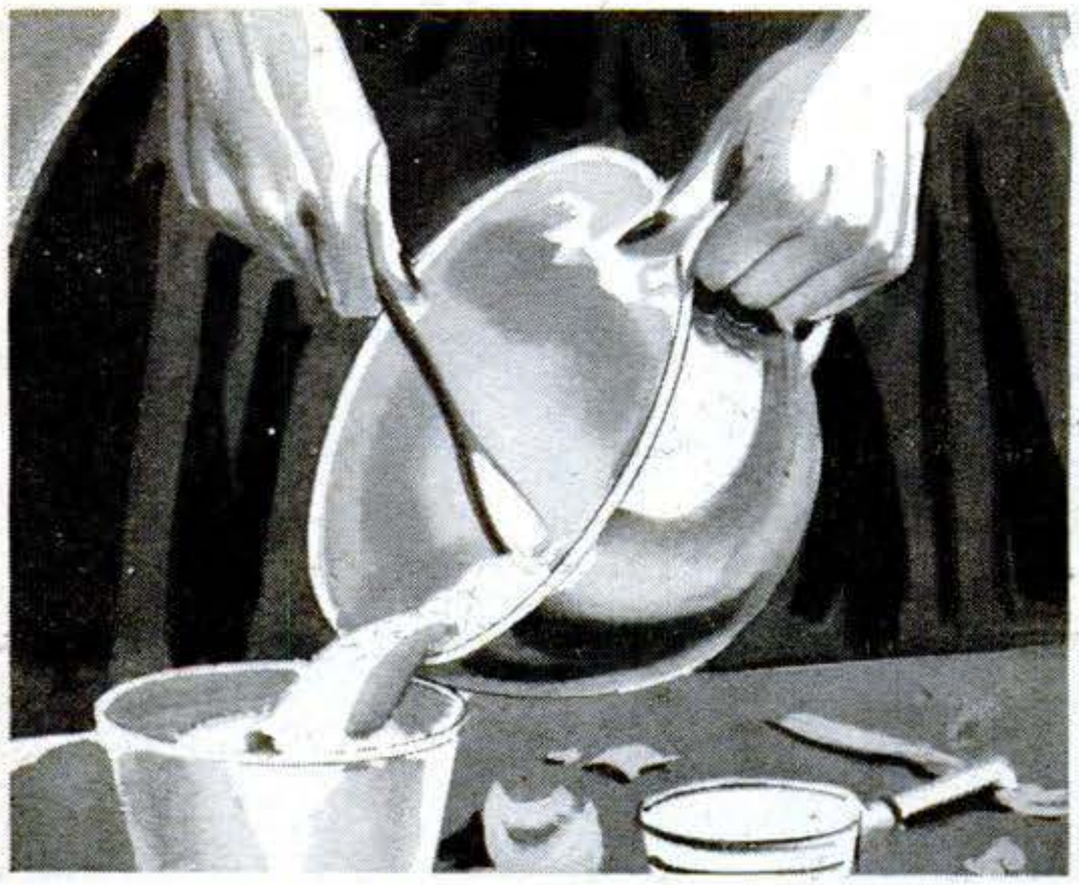
Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.



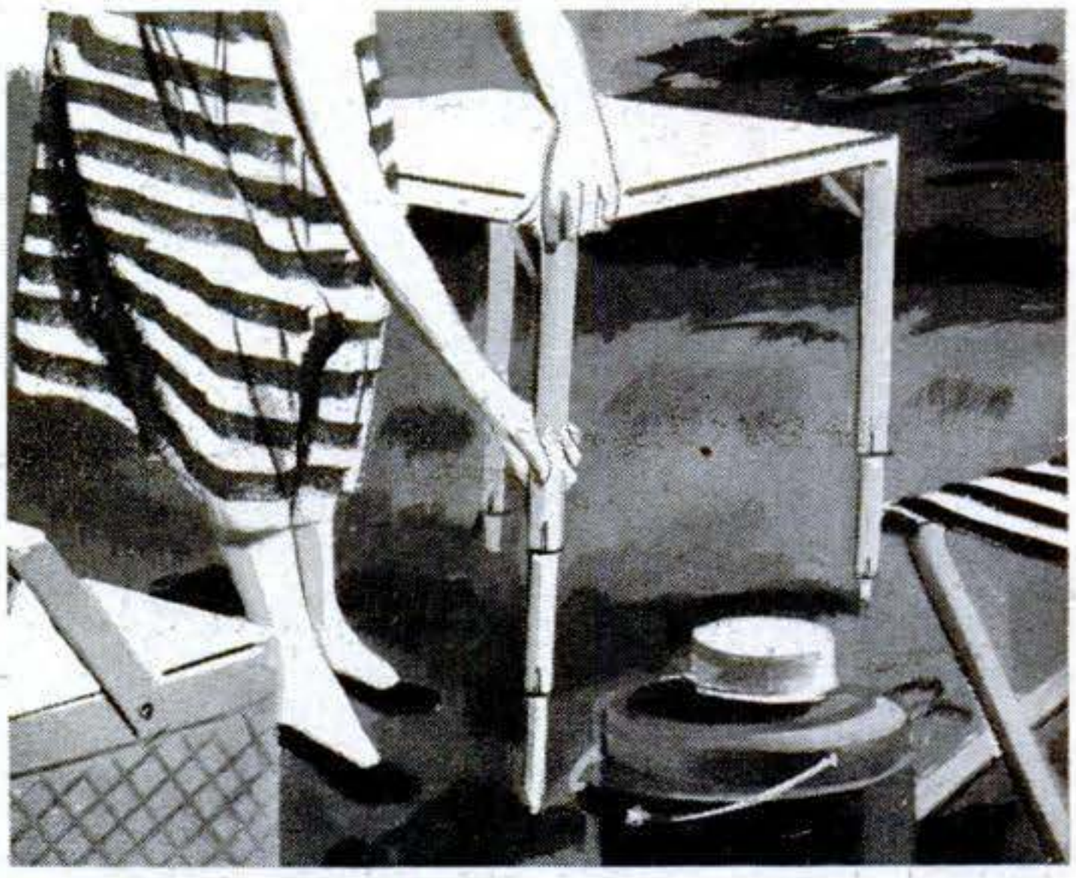
A special screwdriver for electricians that would make hooks on the ends of wires to go under terminal screws. Might be done simply by making a hole in the screwdriver blade.—*Lloyd L. Sparks, New Castle, Ind.*

Gallon jugs with off-center necks. This would let air in as liquids are poured, preventing the "glugging" caused by air struggling to get in as the liquid flows out.—*Clarke Blair, Hagaman, N. Y.*

A plug-in car radio that would fit into the glove compartment or pull out for use as a portable at beach parties and picnics. Could be battery-operated, recharged from car electrical system. —*J. P. Smith, New York.*



Lightweight mixing bowls of plastic or aluminum with handles. The cook could easily hold such a bowl over the cake pan with one hand while scraping out batter with the other.—*Mrs. W. N. Sanders, Bessemer, Ala.*



Garden tables with one or more legs made to telescope so they could be adjusted for height. Provided with such legs, a table could be made to stand level on uneven terraces and lawns.—*A. Zotoff, Tientsin, China.*

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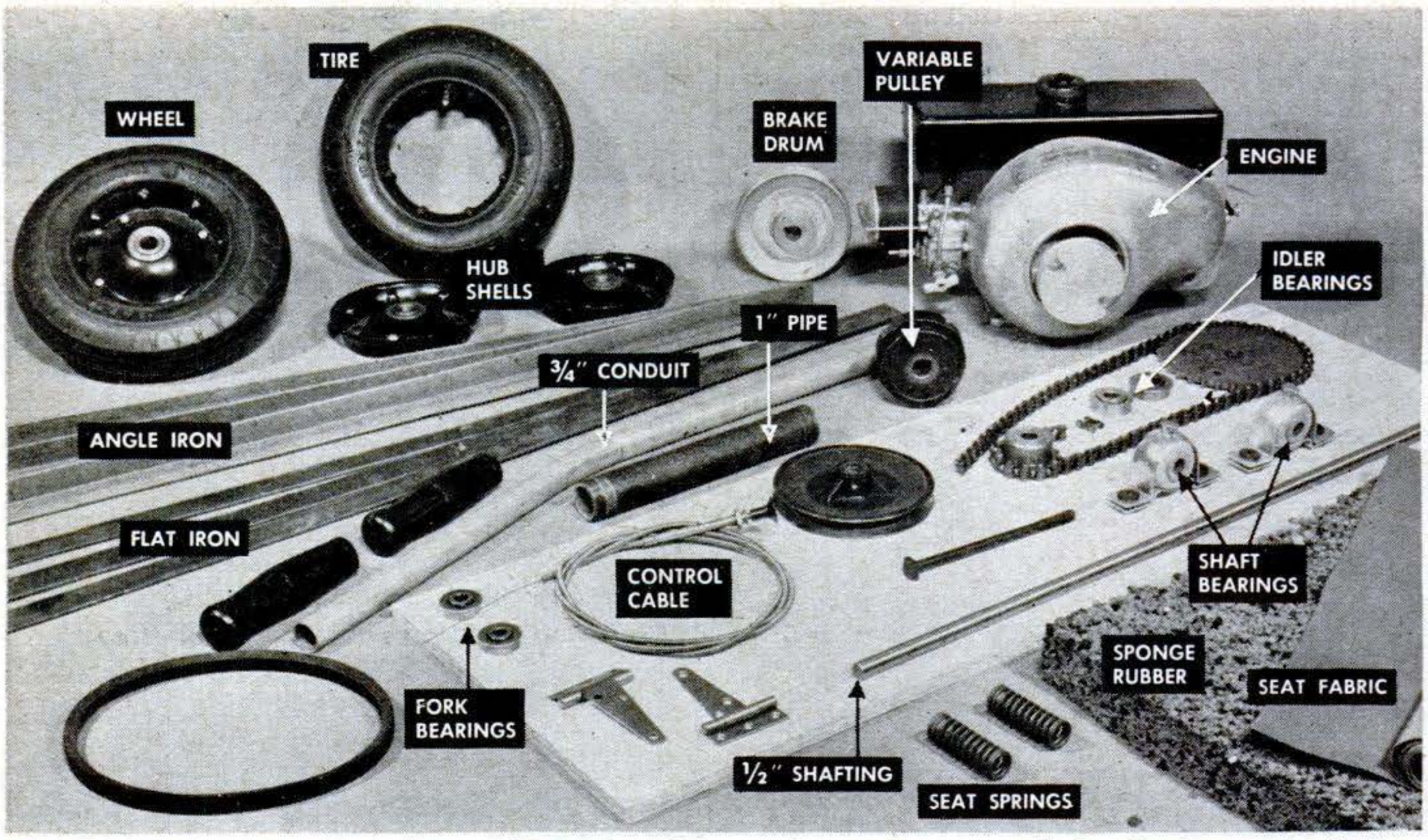
This Scooter Costs Only $75

If you can fix a bike, you can build a put-put that's almost as convenient as a second car and costs far less to run.

By Howard G. McEntee

YOU simply get on this homemade scooter and go. There's no clutch, no gearshift. Open the throttle and you're off. Tackling a grade? It shifts down automatically. When the going is easy, it shifts up again.

Hard to build? No. Though it looks like



These are the main parts, but you'll need such extras as bolts and nuts, ½" and ⅜" pipe, lock washers, sheet metal for fenders, wheel dust seals, and brake and idler springs.

something off a sweet-running assembly line, it isn't a tough job. If you can take a bike apart and get it together again, you can handle this, too.

Scooters are taking thousands to work, school, play, and the corner drugstore for just pennies a day. And no wonder. These little puddle jumpers are a cinch to handle. They park on a grease spot, and can be licensed at bargain rates. This one's a bargain in other ways, too.

What's it got? A lot, in view of today's high prices. Here's what your $75 buys: An easy-starting, lightweight two-cycle engine, an automatic clutch with variable drive ratio, an efficient brake, pneumatic tires, chain drive, lights, and a spring-mounted foam-rubber seat.

The engine is the most expensive item, but fortunately there are reliable two-cycle engines available for $25 or less.* If you have a suitable engine or can rebuild a used one (see PS, June '51 p. 187), this figure can drop to the vanishing point.

What'll it do? You won't beat even a Model A from the light in this little job. But the take-off is smooth, and you'll get where you're going at something like 20 miles an hour. Although it would bust before making Pikes Peak, it will take you up easy grades and can be walked up stiff ones under its own power. The brake is effective, starting is a cinch, and roadability is good. The machine is light enough to carry if necessary, and one man can put it into an auto luggage compartment.

Welding does it. The cost includes $6 for welding the frame, and it's money well spent. Although you could bolt or rivet the frame together, you'd have to overlap members or provide gussets at all joints. But welding service is available everywhere, and a welded frame is much easier to make, neater looking, and stronger.

You'll find most welders cooperative, especially if you cut and fit frame members correctly and clamp them in proper alignment. Electric welding is preferable. It's less likely to warp the stock.

Cutting the frame. Two 45" lengths of angle iron must be cut, bent, and welded at two points. For the 30° upward bend, cut through one flange of each piece 12½" from an end. Watch yourself, for these members are not identical; you need a right and a left. Bend the uncut flange, spreading open the cut. Then have ⅛" reinforcing plates welded across the breaks.

The second bends are in the other flanges, and require narrow notches. These are closed up by bending, and need no reinforcing, just careful welding. The front of the frame is filed to fit around the head. Try to make the two parts a reasonably close

**I bought a Power Products 1000 from Airmerchant, Springfield, Mass.*

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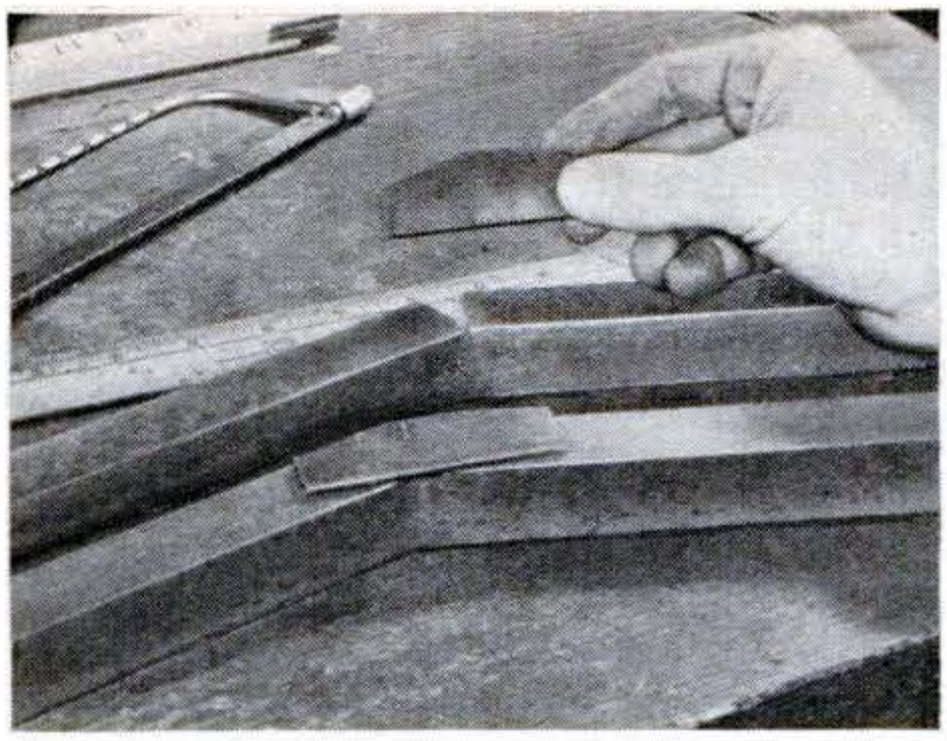
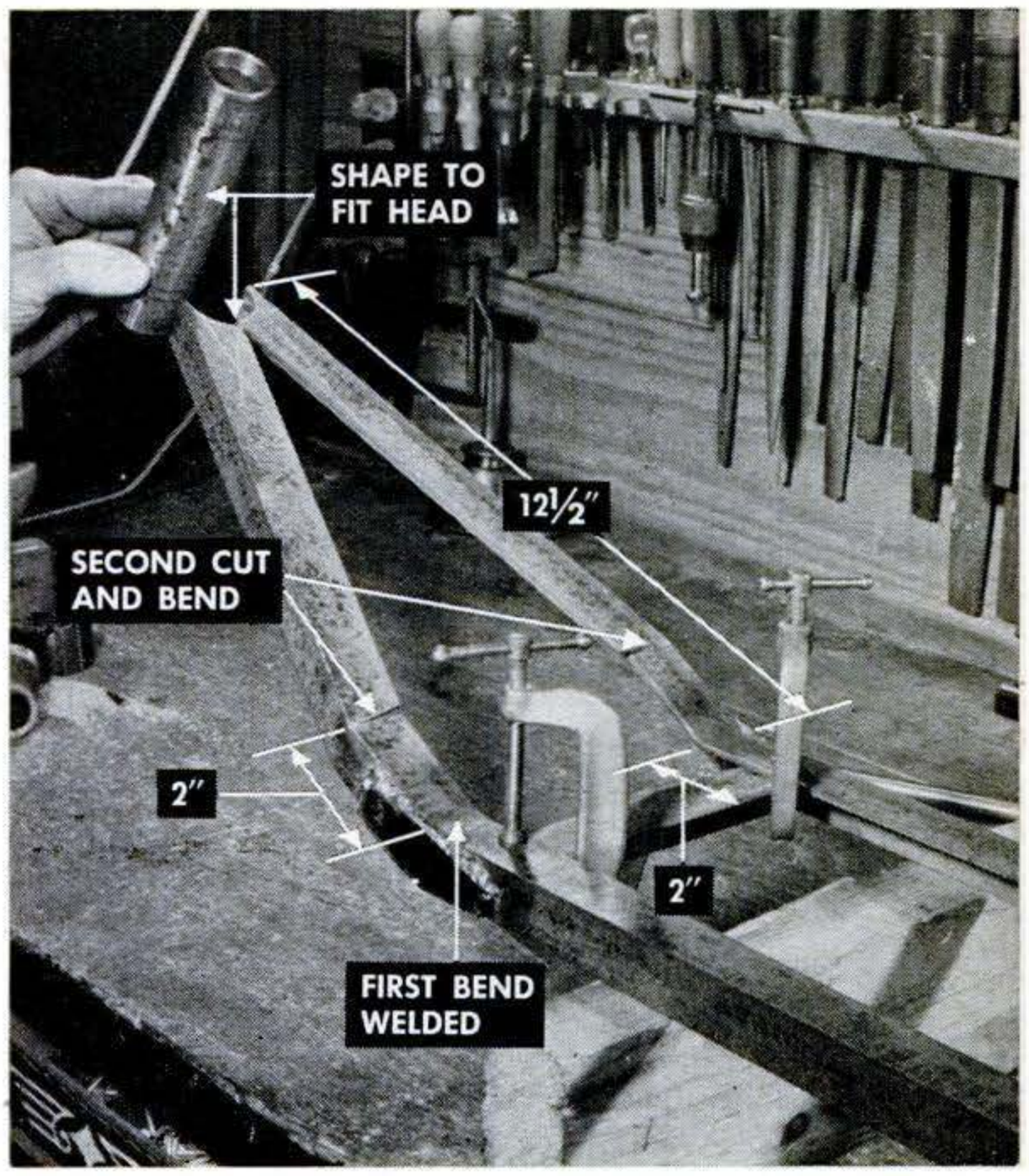


Measuring 12½" from ends of main frame members, cut through one flange, and bend the other up about 30°. Be sure to make one right, one left. Cut ⅛"-thick braces to be welded across the breaks. Weld across them inside the angle also.



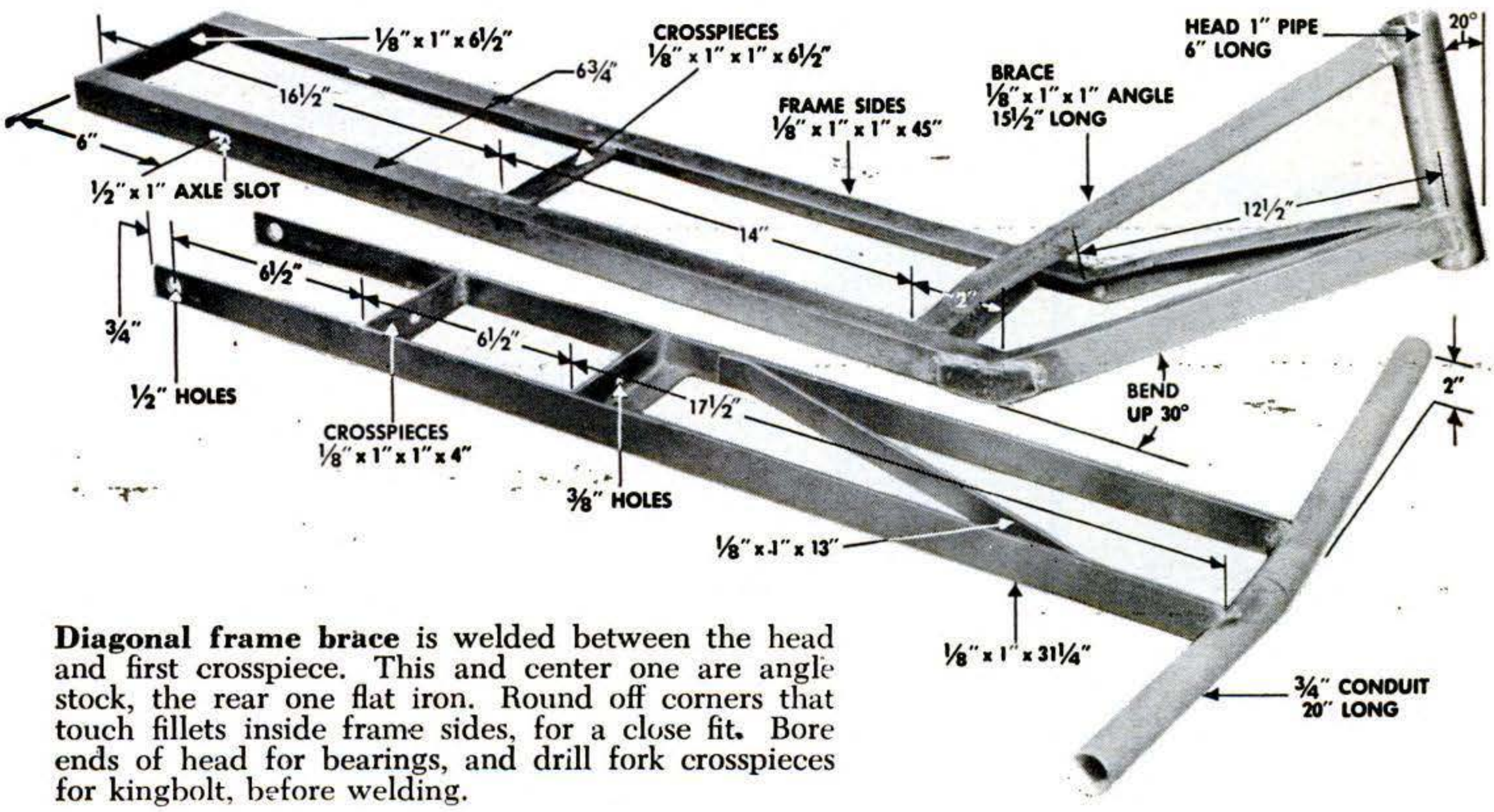
First bend (at right) has been welded in both members and a ⅜"-wide V notch cut 2" above it. Second bend closes these notches, ready for welding. Clamps hold a crosspiece in place. Head (in hand) will be welded to rounded frame ends.

match, but don't fret about it, for welding will close up small gaps.

Assembling the frame. The fork turns in ball bearings like those in the wheels, but made for a ⅜" axle. The 1" pipe for the head can be bored out in a lathe to fit the bearings, or filed by hand, since the outer race does not turn. Cut the angle brace. Then wire it and the head in place for welding, or drill the frame members for a clamping bolt and have the holes welded up later. Make sure the head is vertical to the frame, as viewed from the front, or your wheel will be askew.

Note that, except for the axle slots, no holes are made in the vertical flanges of the long frame members. All other holes go in the top flanges, which don't carry much of the load.

The scooter shown was assembled mostly with square-shoulder carriage bolts, for which you must file the hole square. This



Diagonal frame brace is welded between the head and first crosspiece. This and center one are angle stock, the rear one flat iron. Round off corners that touch fillets inside frame sides, for a close fit. Bore ends of head for bearings, and drill fork crosspieces for kingbolt, before welding.

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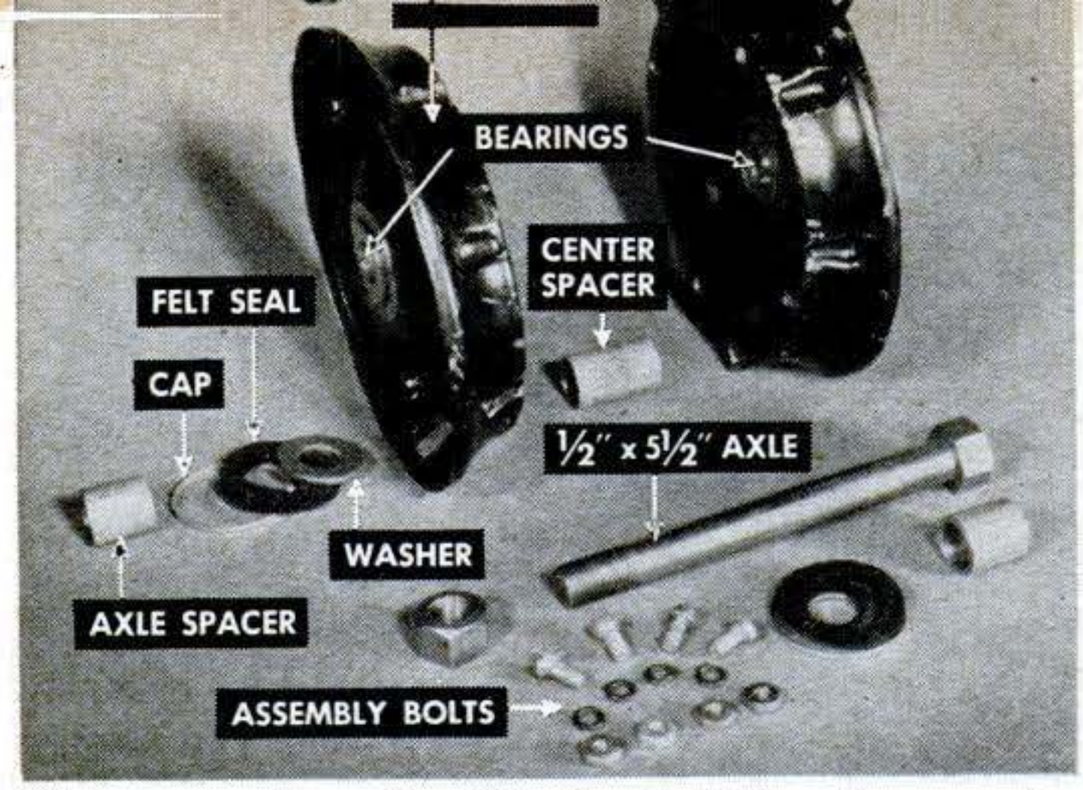
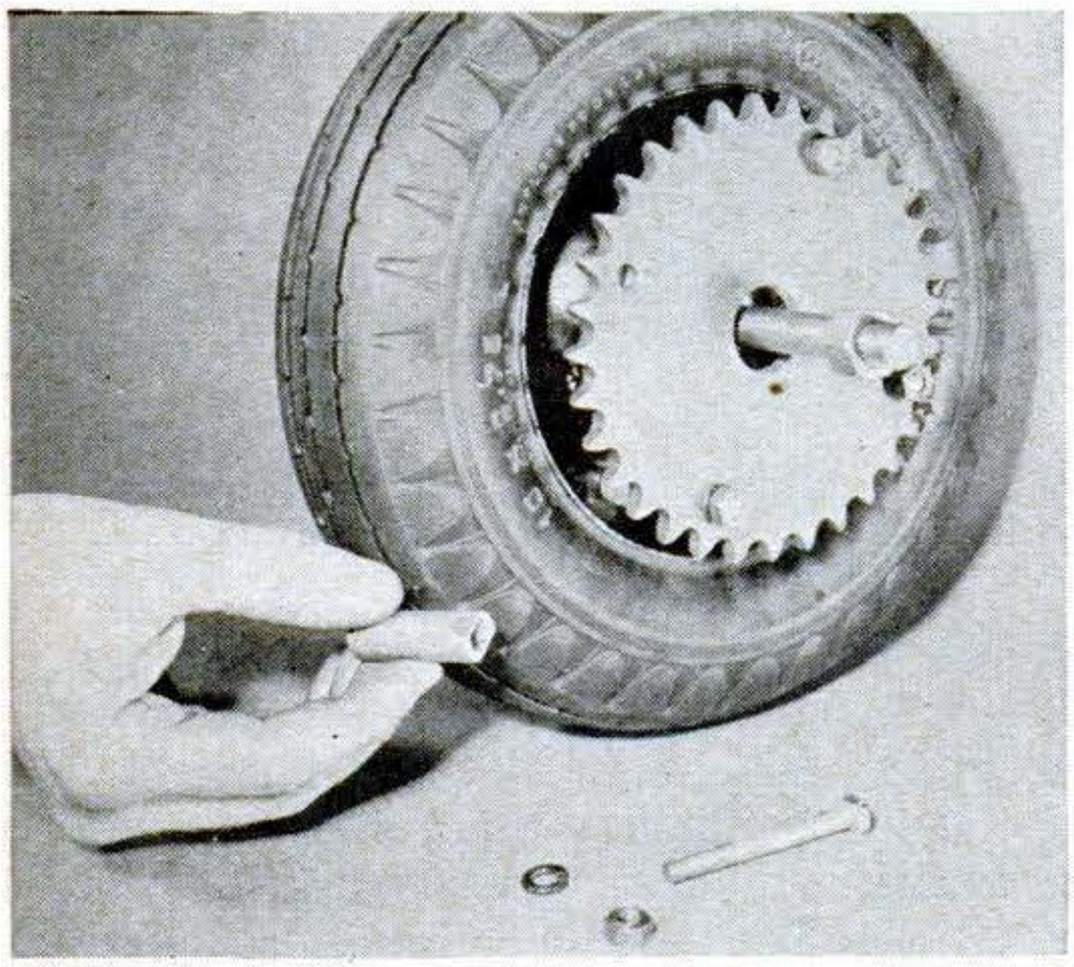
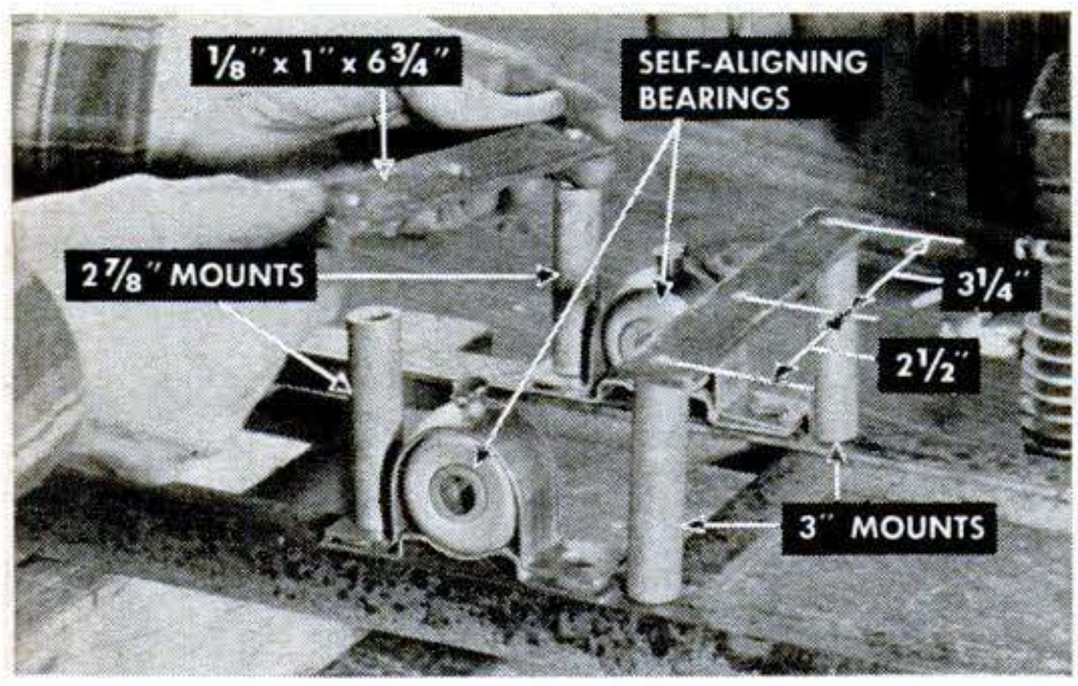


Makings of a wheel hub. Ball bearings are in place in the shells. Center spacer must clamp between inner races without binding the bearings. A lathe is ideal for facing spacers squarely to length. Felt seals prolong bearing life. Bolts and nuts clamp hub together.



Industrial type sprocket used here was bored out to clear the axle spacer. Sprocket is set off by four spacers 1 9/16" long, cut from ⅜" pipe. Spacer ends against sprocket are square, but inner ends are filed to contour of hub shells. The holes in the shells must be opened out to clear ¼"-20 bolts.



Front engine mounts rest directly over the center frame crosspiece. The rear ones sit on the bearing hangers, and therefore are ⅛" shorter. All mounts are cut from ½" pipe. Iron straps across them provide an inboard support for the engine base, in which the mounting holes are 3¼" apart.

takes only a few seconds and saves time in assembly, because it isn't necessary to fumble underneath with wrenches to hold a bolt while cinching up the nut.

Lock washers under all nuts are, of course, a must if you want the scooter to be roadworthy. Don't under any circumstances omit them.

Wheels. These are 10" by 2.75" tubeless pneumatics, inflatable through a valve. Valveless (semi-pneumatic or zero pressure) tires give a harder ride. Be sure to get the heavy-duty grade, since light-service tires of both types aren't recommended for much more than wheelbarrow speeds.

At least the rear wheel must be the lug-base type, having molded protuberances on the tire that fit indentations in the hub. Make certain you have this kind, or you may find the hub going around while tire, scooter, and rider stay put.

To prevent the bearings from turning directly on the axle, the inner races must be clamped against a center spacer. This and outside spacers can be cut from ordinary ½" pipe drilled out a bit. Each center spacer must be carefully fitted. If too long, it won't allow the hub to be assembled; if too short, it will bind the bearings. Each wheel must turn freely when clamped with axle nuts with the center spacer in. Start with this spacer a trifle long, and shorten it a little at a time.

The front axle is simply a ½" hex bolt 5½" long. If you can't get one 8" long for the rear axle, use a square-head machine bolt or a ½" shaft threaded at both ends.

Chain drive. The roller chain shown is No. 41, ½" pitch and ¼" wide. This is stronger than necessary. Similar chain ⅛" wide is stocked by bicycle stores and will serve as well.

The sprockets should give a ratio of about 2½ to 1. The large (32-tooth) sprocket is fastened to the rear hub with ¼"-20 bolts on spacers cut from ⅜" pipe. Mount the wheel and spin it to help you true up the sprocket.

Countershaft. Bearings are the self-aligning type, which make assembly easier than rigid bearings. The ½" countershaft must be at 90° to the frame, with the rear axle parallel to it, for quiet chain operation. The small sprocket (13-tooth) must be pinned to the shaft. Setscrews will not hold. Drill a hole through hub and shaft, ream with a No. 3 taper reamer, and drive in a taper pin.

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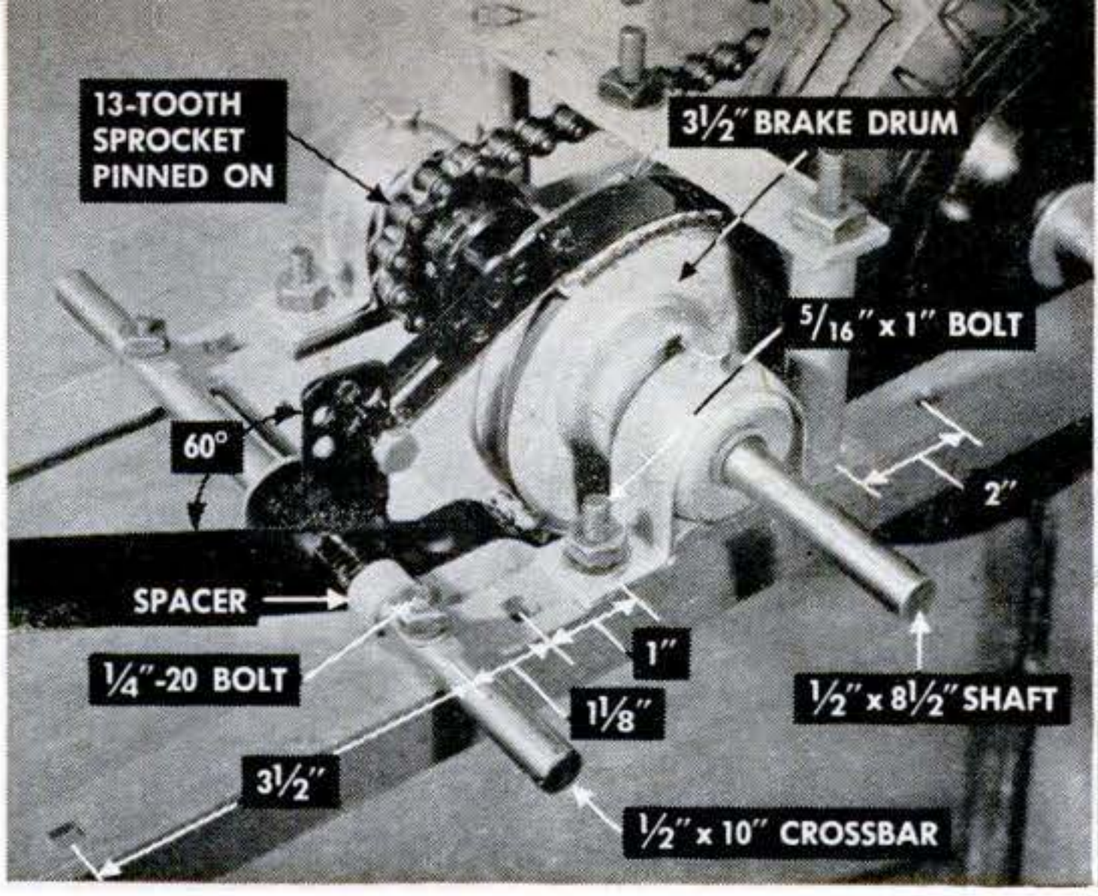
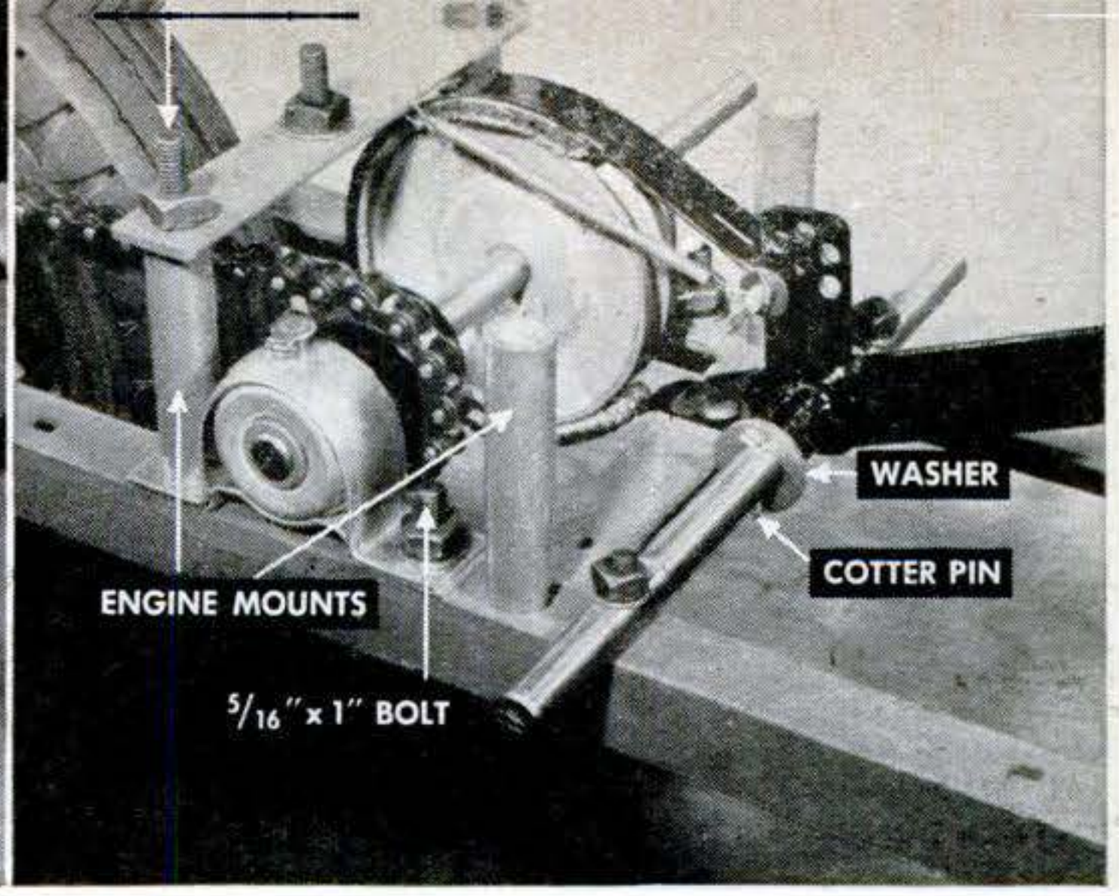
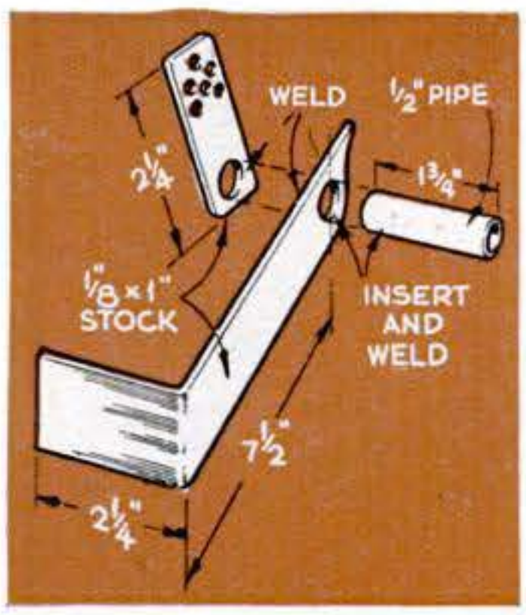
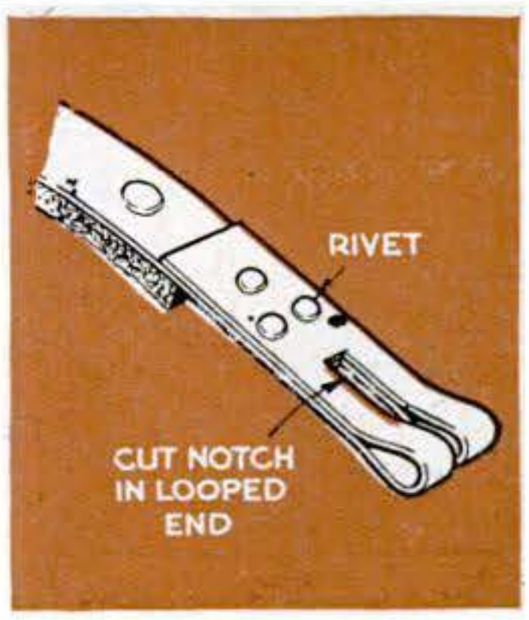






A crossbar of ½" shafting is filed flat where it crosses the frame, and bolted on. Brake lever is welded of ½" pipe and 1" strap as at left. It pivots on the crossbar. So does the idler bracket on the drive side and the kick stand on the other. Pointed end of brake lever strikes frame crosspiece as a stop. Brake band is looped over, riveted, and notched to form clevis as at right. Clevis pin is unthreaded portion of a bolt. Lower end of brake band is bolted to frame crosspiece. Engine will rest directly on straps, not on nuts shown.



A shaft collar goes between this sprocket and the nearer bearing. The brake drum takes the side thrust at the other bearing. Leave just a little end play.

Brake. Use a 3½" steel or cast-iron flat pulley for the drum if possible—a die-cast one will wear rapidly. The scooter shown has an iron V pulley with the sharp ridge turned off the flanges. Pin the drum fast, or use two setscrews tightened against flat spots on the shaft.

The brake band is a flexible strip of 1/16" by ¾" steel. Bend the band around the drum before riveting on some ⅛"-thick woven brake lining. Bolt the lower end of the band to the frame crosspiece and form the other into a clevis as shown.

Extra holes in the brake lever allow for adjustment, and a spring normally holds the band off the drum. Braking action tends to wrap the band around the drum, which makes the brake very responsive.

Engine. For the engine shown, cut four mounts from ½" pipe and two straps of ⅛" by 1" stock. These give an inboard support for the engine base, which is narrower than the frame.

The engine comes with a governor, which should be removed. An auto choke cable 72" long is connected to the throttle. Attach a spring to hold the throttle closed unless the button on the handlebars is pushed.

The muffler on this engine interferes with the drive pulley. Take it off, separate the two aluminum castings, and, using the mounting holes and port in one as a template, mark new ones on the other. Drill and file them out. Plug unneeded holes with bolts and gasket cement, leaving the original cylinder port as the exhaust.

Before mounting the engine, put lock washers under the three screws that hold the crankcase to its base. Tighten the screws hard. You don't want them to loosen under vibration, for they are difficult to reach with the engine in place.

Belt drive. It's the centrifugally controlled pulley, acting as both clutch and variable-ratio drive, that makes the 1-hp. engine perform as well as it does. Some pulleys of this type will serve as a clutch, but offer little or no ratio change. The one I used, a V-Plex clutch model 18T9*, shifts from a drive-belt diameter of ¾" at rest to one of 2¼" at high speed.

The keyway on the engine crankshaft may not be long enough to let the pulley slide close in. To remedy this, grind out one of the two keys cast into the bore of the pulley.

An idler keeps the belt taut. Adjust the pull of the idler spring so that it holds the belt taut over the entire shift range, yet leaves the belt loose when the engine is idling.

[*Continued on next page*]

**Made by Light Inspection Car Works, Hagerstown, Ind. $7.95.*

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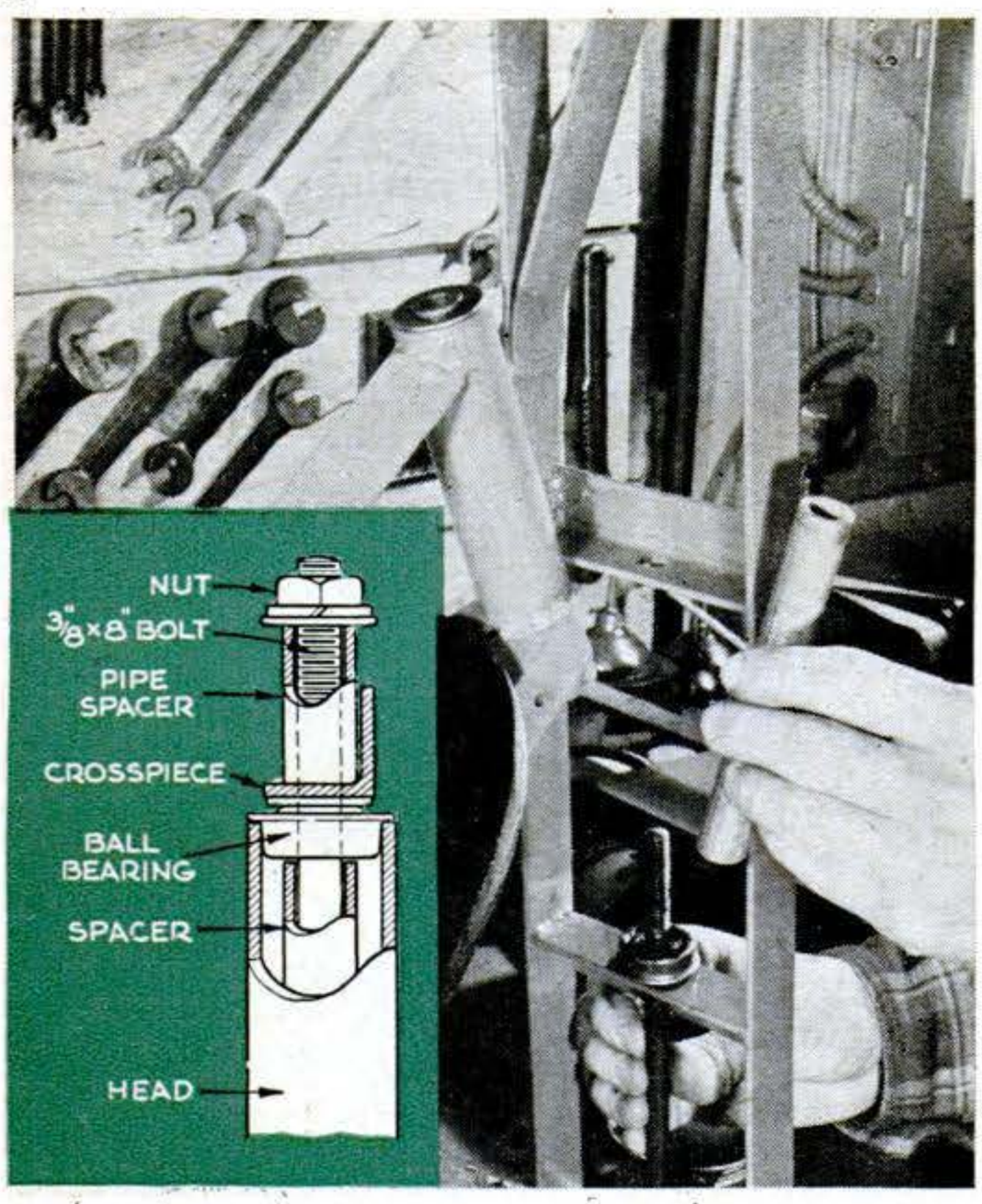
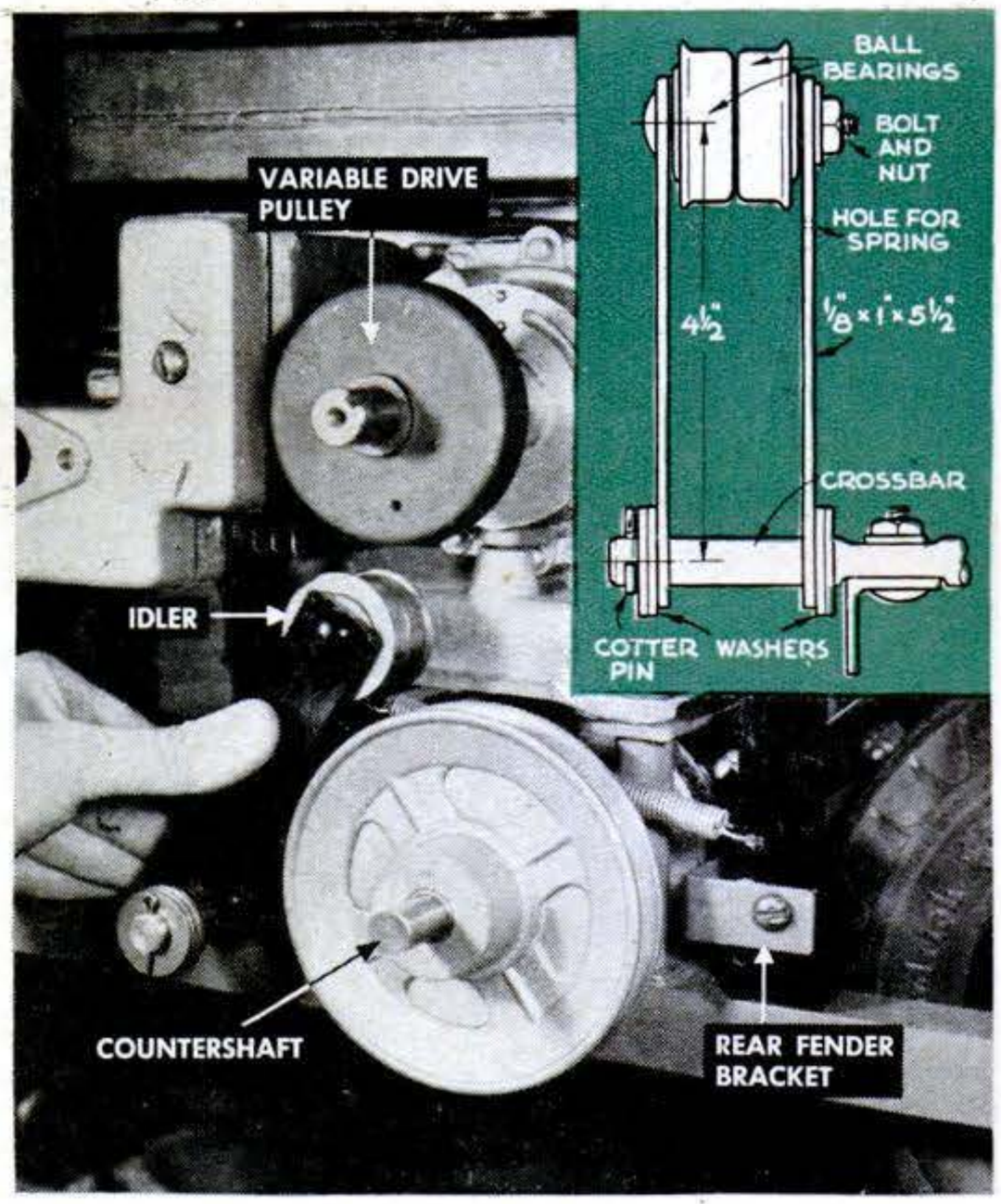


Ends of frame head receive ball bearings like those in the wheels, but with ⅜" hole. Here the lower bearing is on the king bolt over lower fork crosspiece. Spacer held in the hand goes between the bearings inside the head. Short spacer raises nut above top crosspiece for access. Be sure to use lock washer.



Motor pulley changes flange spacing as engine revs up, changing ratio and also acting as a clutch. Idler takes up belt slack. It consists of two ball bearings bolted to straps that pivot on the crossbar. Muffler has been reversed to clear drive pulley. Its cylinder-mounting boss is now the exhaust opening.

The best over-all drive ratio will depend on the kind of roads you travel. In flat country, with 13- and 32-tooth sprockets, a 4" pulley on the countershaft may suffice. In hilly territory, a 5" pulley may be necessary, or you may want a smaller drive sprocket.

Fork assembly. Like the wheel bearings, those in the head should be clamped against a center spacer. Remember to insert felt washers and dust caps to keep grease in and dirt out. If you can't buy them, you can improvise them from felt rings and ½" washers, with a smaller washer inside the felt ring, as shown in the photos.

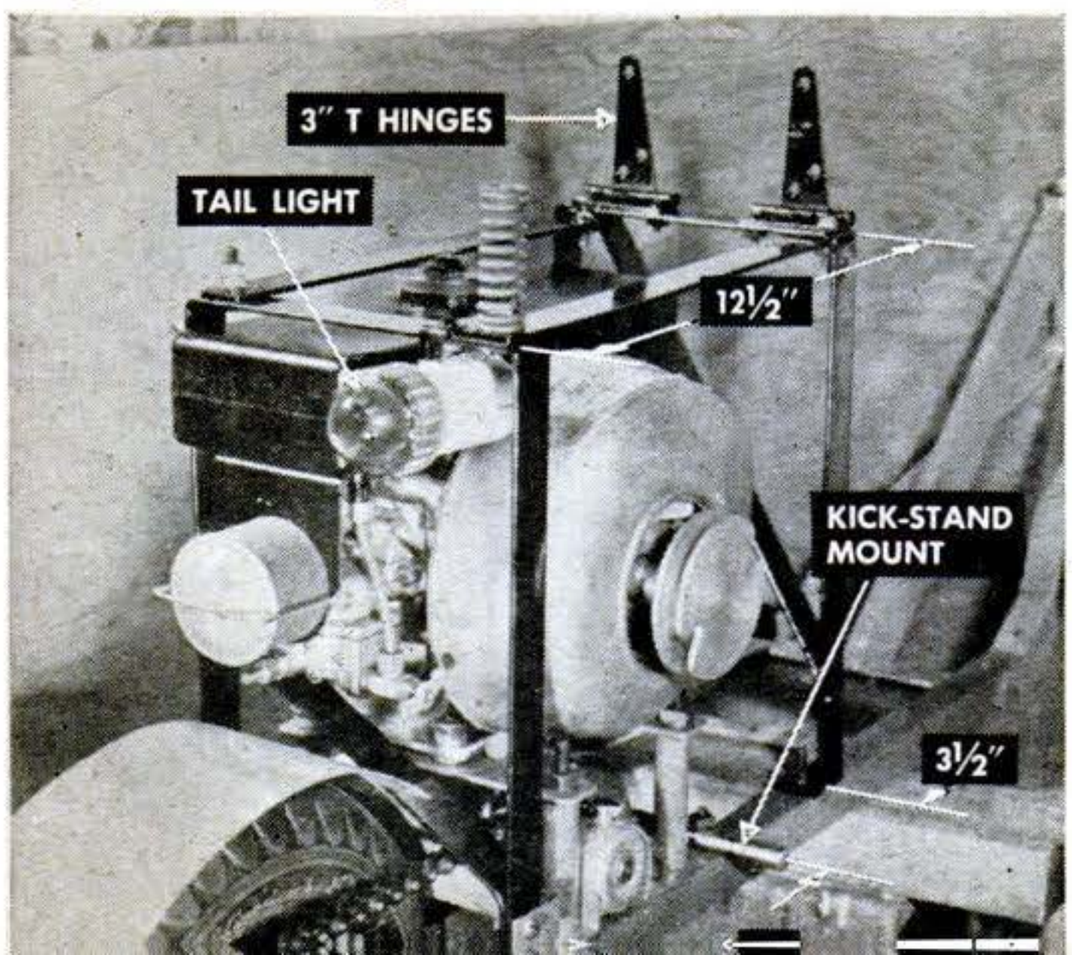
The trimmings. In fitting the seat support, make certain it clears the carburetor, gas tank, and muffler by at least ¼" all around. Cut the floor boards from ⅜" or ½" plywood, and attach them with ¼" carriage bolts.

Some states require a tail light, head lamp, and horn before the scooter can be licensed. Battery lights sold for bicycles will serve, but if you want to use a magneto-type (battery-less) lighting outfit that is powered from a wheel, better check its legality in your state.

Trial run. Follow instructions on the engine name plate for mixing oil with gasoline. Always close the fuel petcock and if possible run the carburetor dry (which takes several minutes) when leaving the scooter overnight. Otherwise the carburetor jets are likely to clog with oil, making starting difficult.

Be sure to carry your starting rope at all times. A scooter with a centrifugal clutch can't be started by pushing, although in an

Seat frames are fastened with ¼" bolts. Make certain the brace in rear frame clears the carburetor amply. Kick stand goes on this end of crossbar. Valve springs, turned over a pair of nuts on each rear frame bolt, rest in shallow holes in plywood seat. The seat must hinge to give access to gas tank.



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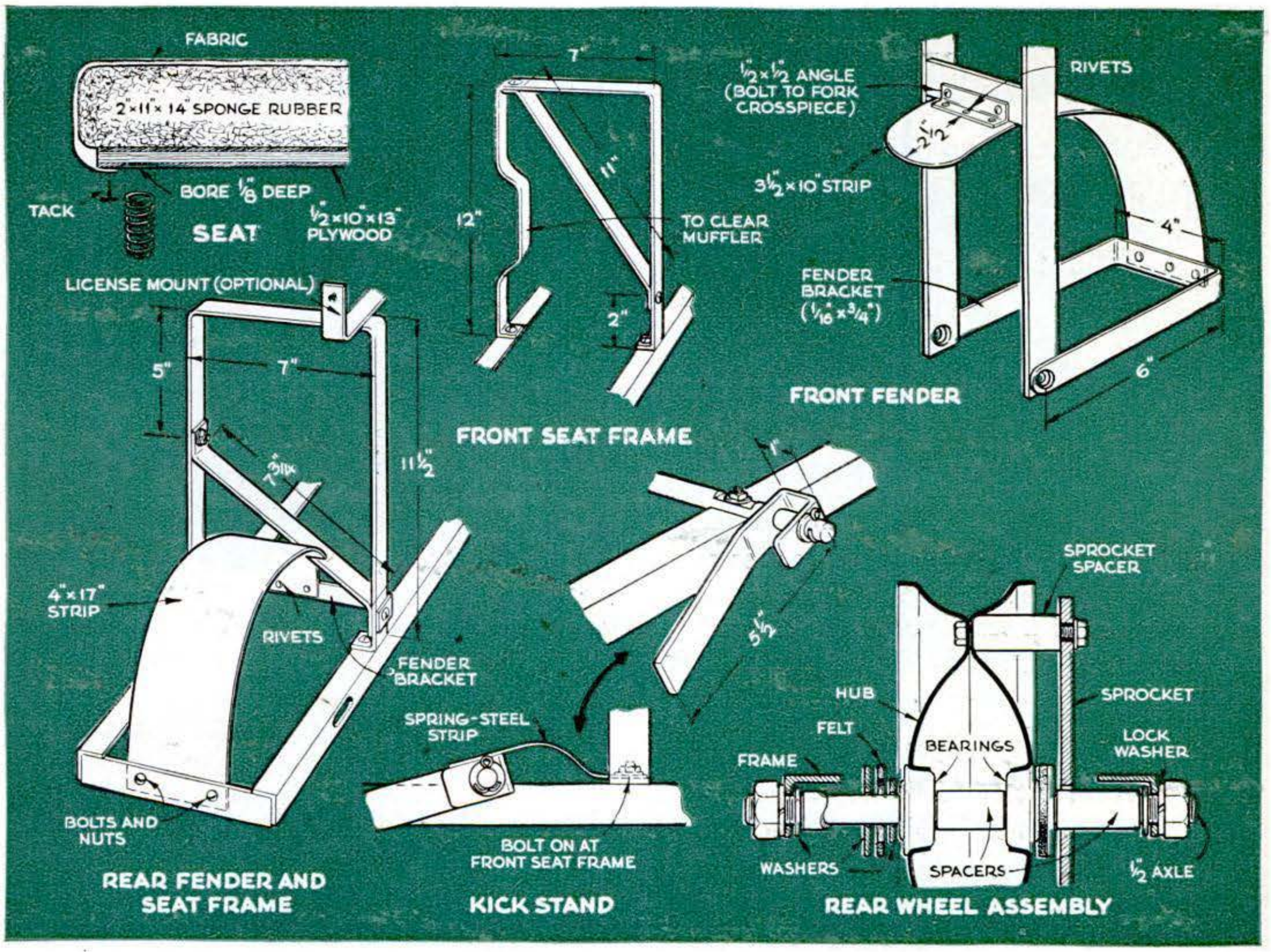


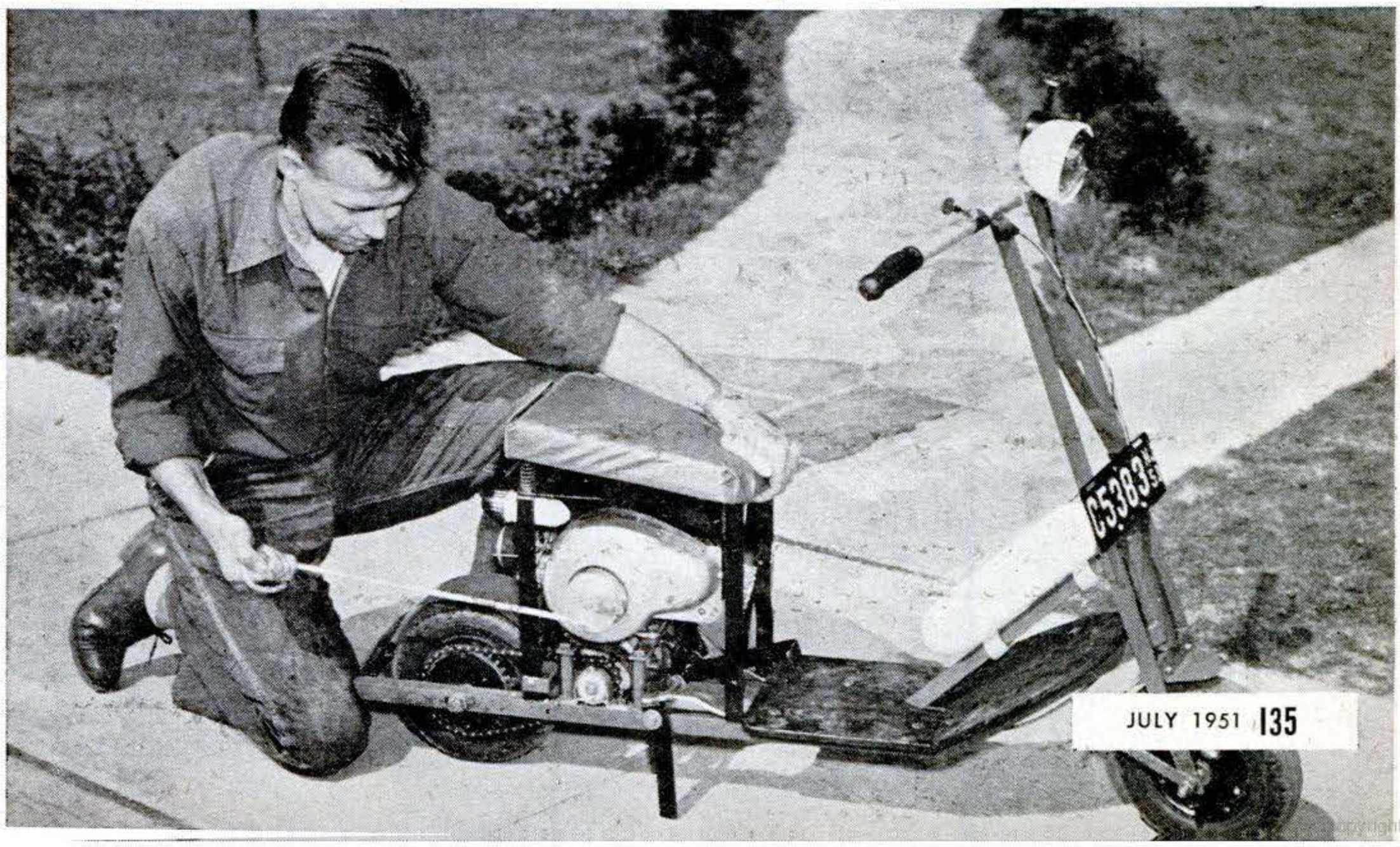
emergency you can probably start the engine with a handkerchief, knotted at one end and twisted into a short starting rope.

If the scooter tries to get away from you at low engine speeds, lower the idling speed. Also, check belt-idler tension. Fit a stop to the idler bracket if necessary. On the other hand, failure to "take hold" may be due to too large a belt or insufficient idler tension. Remember that most belts will stretch after short use, so it's well to start with a slightly tight one.

Up- and down-shifting will be governed in part by the tension of the idler spring, so you may want to experiment with this.

Get your license, practice on some lonely road until you get the feel of the thing, and you're set for happy scootering. END

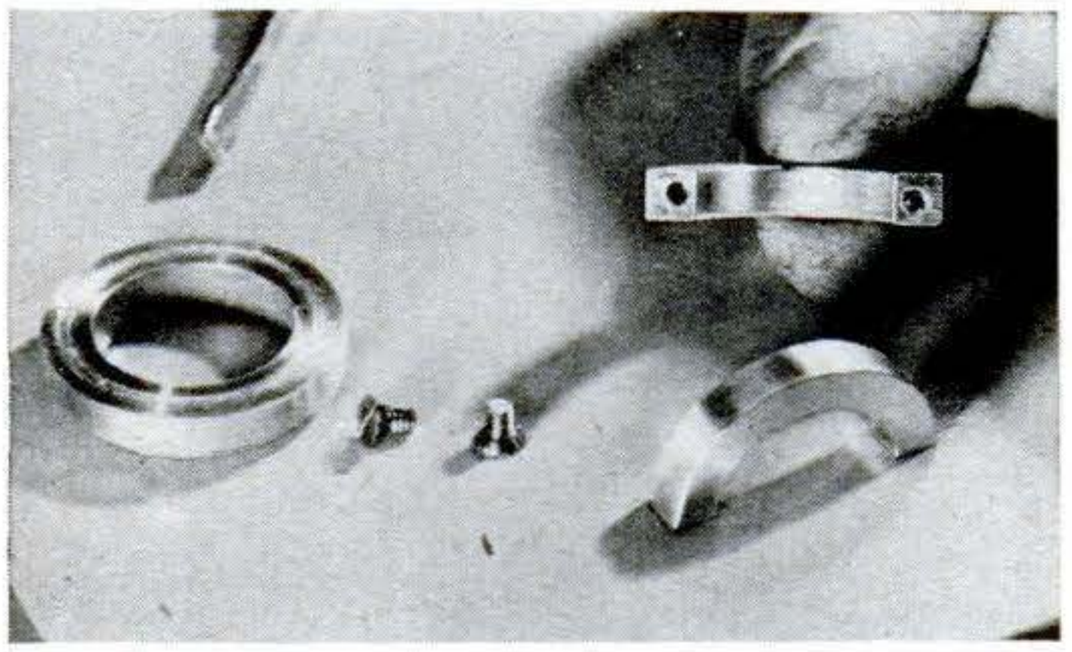
A quick yank starts the engine. Run carburetor dry when you stop, or jets may clog with oil.



Egg Carton Protects Radio Tubes

WHAT an egg carton does for eggs it will also do for radio tubes. When you have to take tubes to a service shop, a carton like the one above will keep half a dozen from banging each other.—*H. Leeper, Canton, Ohio.*

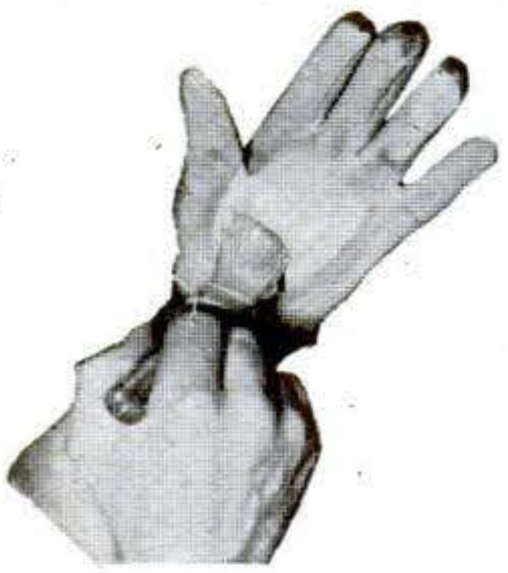
Cabinet Handles Made on Lathe



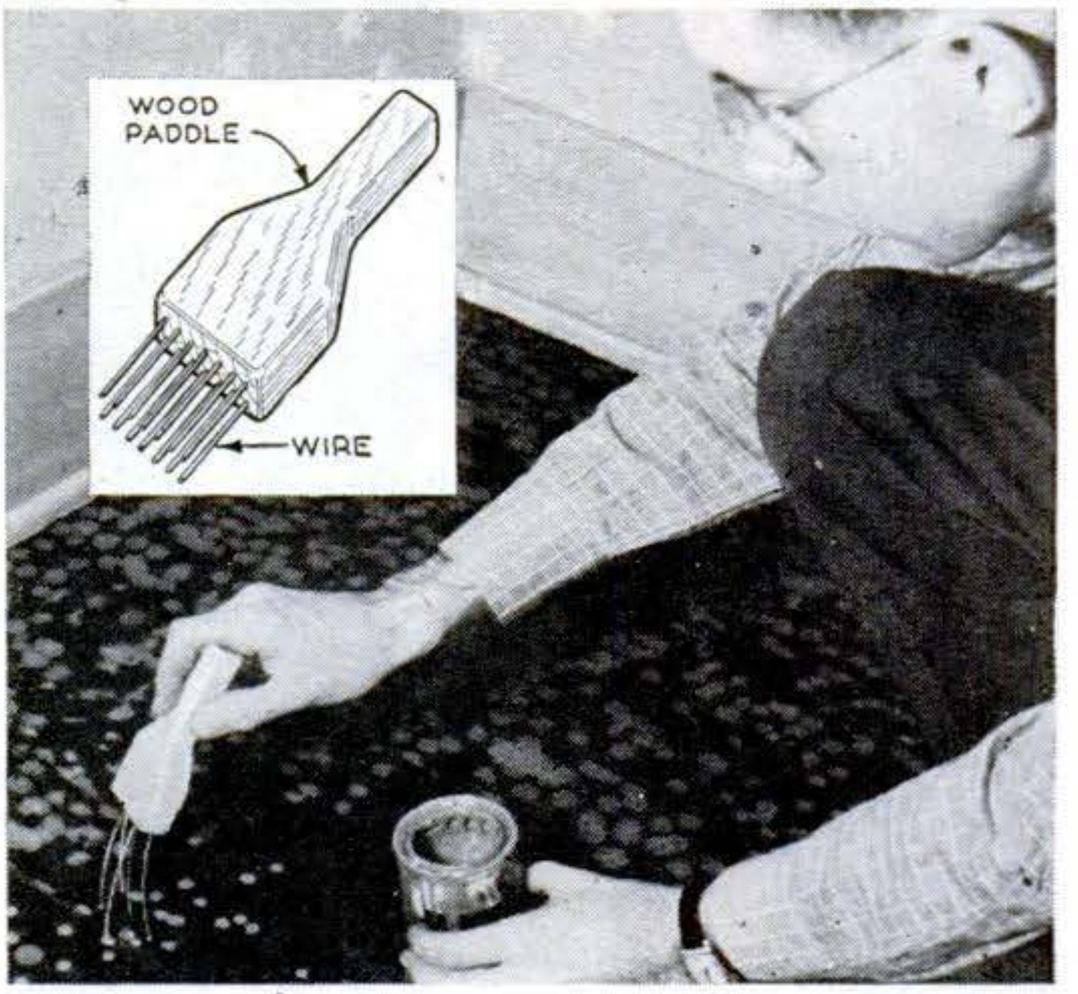
WOOD, plastic, or metal handles for cabinet doors and drawers can be made easily on a lathe. Machine a ring with a diameter equal to the length of handle desired. The ring can be turned to any cross section you like—square, oval, or something fancier. Cut it in two to make semicircular segments and drill and tap holes in the ends for mounting screws.—*W. E. Burton, Akron.*

Paint Gives Work Gloves Better Grip

THE cotton gloves commonly used in shop and garden have an aggravating tendency to slip on the tool or work being handled. They'll grip better if you paint the palm and fingers of each glove lightly. Any kind of paint will serve this purpose.—*Ivan Grosvenor, Richmond, Ind.*



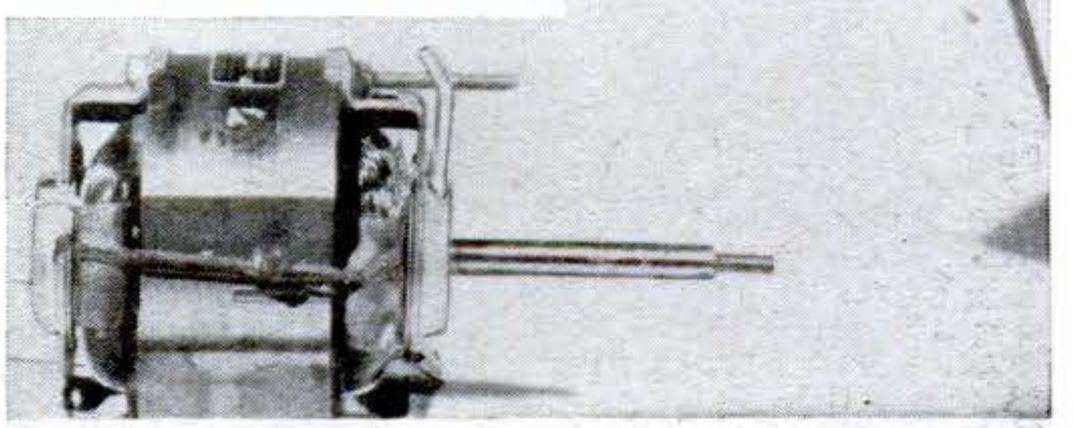
Tool Simplifies Spatter Painting



IT'S hard to spatter paint when you're trying to, but this simple tool will make it easier. Force the ends of half a dozen or more lengths of wire into the end grain of a paddle-shaped wooden handle. The wires can be straight or slightly curved. Dip the wire tips into the paint and allow the drops to fall to the floor, or dab the floor with the wire ends. Make sure the floor is free of dust first.

Portable Stroboscope Fits Pocket

THIS portable, pocket-sized stroboscope lets engineers in the field make quick tests of synchronous motors and similar devices without hauling out a lot of bulky equipment. Only 5″ long, it has a cold-cathode triode tube that gives off a light pulse only during the positive part of the AC cycle. Directed on a motor shaft, these light pulses, flashing at the same frequency that controls the motor, make the shaft appear to stand still if it is correctly synchronized. Synchroscope Co., N.Y.C., is the maker.



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How to Patch an Inner Tube

New tricks and tools have been added since Model-T days. Would you know how to use them—if you had to?

By R. P. Stevenson and Walter E. Burton

TIME was when every driver had to know how to patch a tube. Flats were frequent, service stations were far apart, and a grunt-and-strain roadside repair was often the only way to get home.

Today, it's good common sense to prepare for such jobs again. Replacement tires

1. If injury is a cut, trim to dumbbell shape, rounding ends and corners so the rubber won't tear further. Roughen rubber with grater for ½" or so in each direction past the injury.

2. Apply cement to roughened area and edge of hole and immediately scrape off with a knife blade. This is to clean the area well. Apply second coat of cement and let it get tacky.

3. If you cut your own patch, round the corners and bevel edge to 45°. Pull off the protective covering and apply the patch.

4. Roll the patch into firm contact with the tube. You can use the kit box or any round tool that has a smooth work surface.

are scarcer, and you may eventually find yourself without a decent spare. Running on worn tires increases chances of a flat.

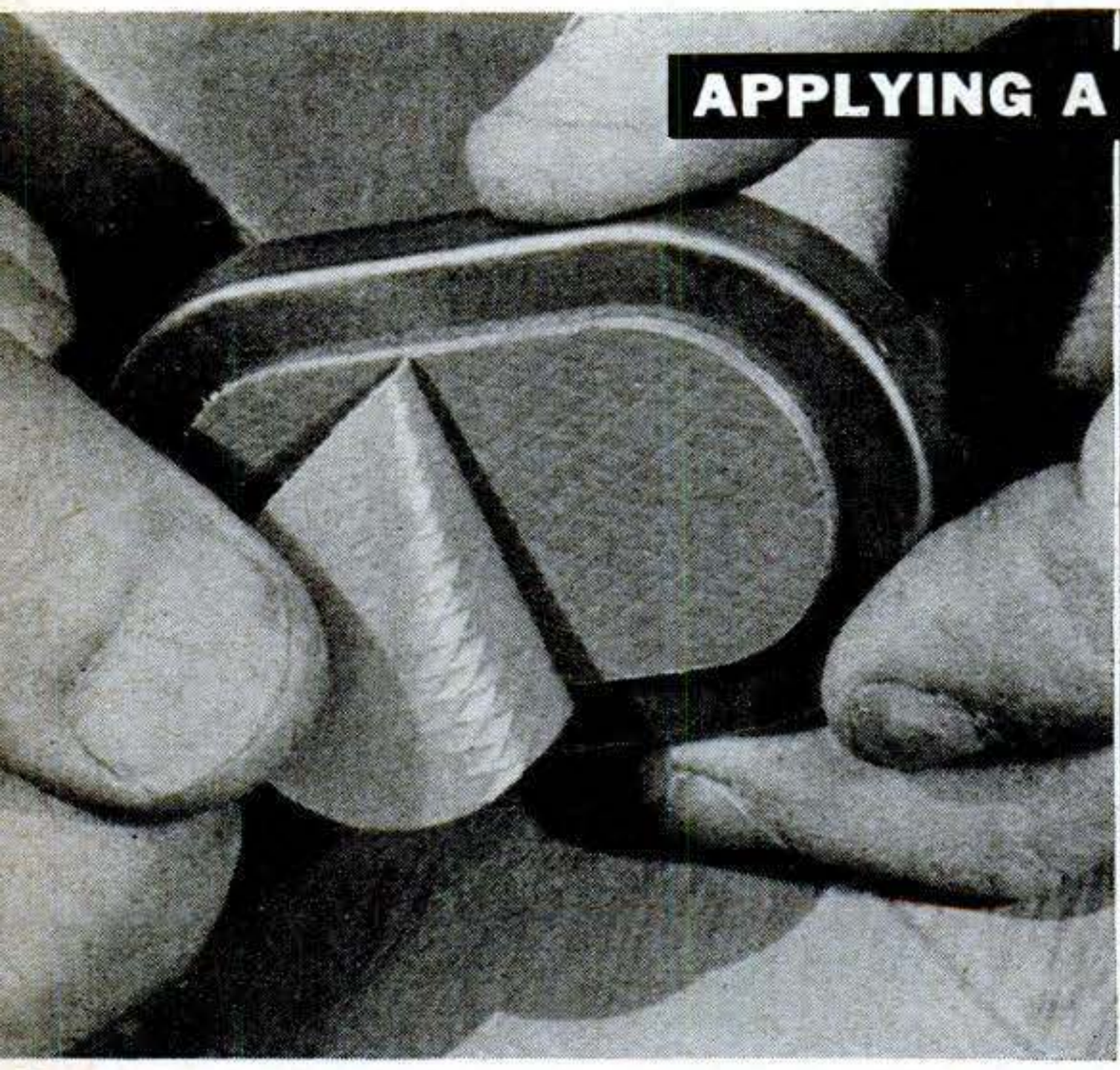
New patching tricks have been added since synthetic tubes were introduced. Most passenger-car tubes nowadays are butyl, identified by a blue stripe on the rim area. A few GR-S (red stripe) and other synthetic types made several years ago may also be encountered.

To repair a butyl tube, you can use either a cold or hot patch. A cold patch will get you home, but all the rubber experts advise substituting a hot patch as soon as you can. A cold patch is still okay for natural-rubber tubes.

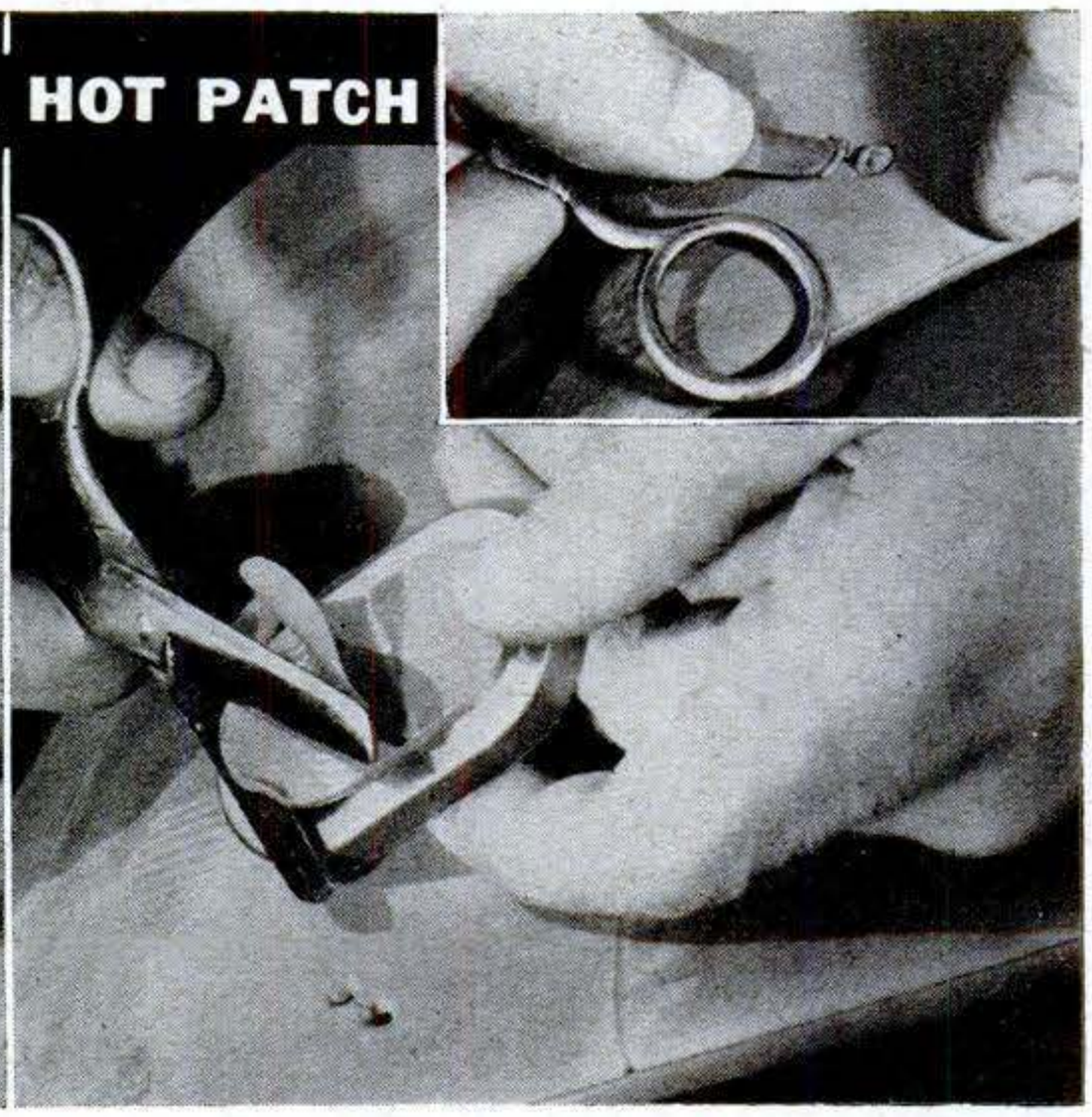
You can buy inexpensive kits for both types of patching. The usual hot-patch kit will repair nail holes and cuts less than 1″ long.

Putting a butyl tube into a tire also takes some new know-how. Tire manu-

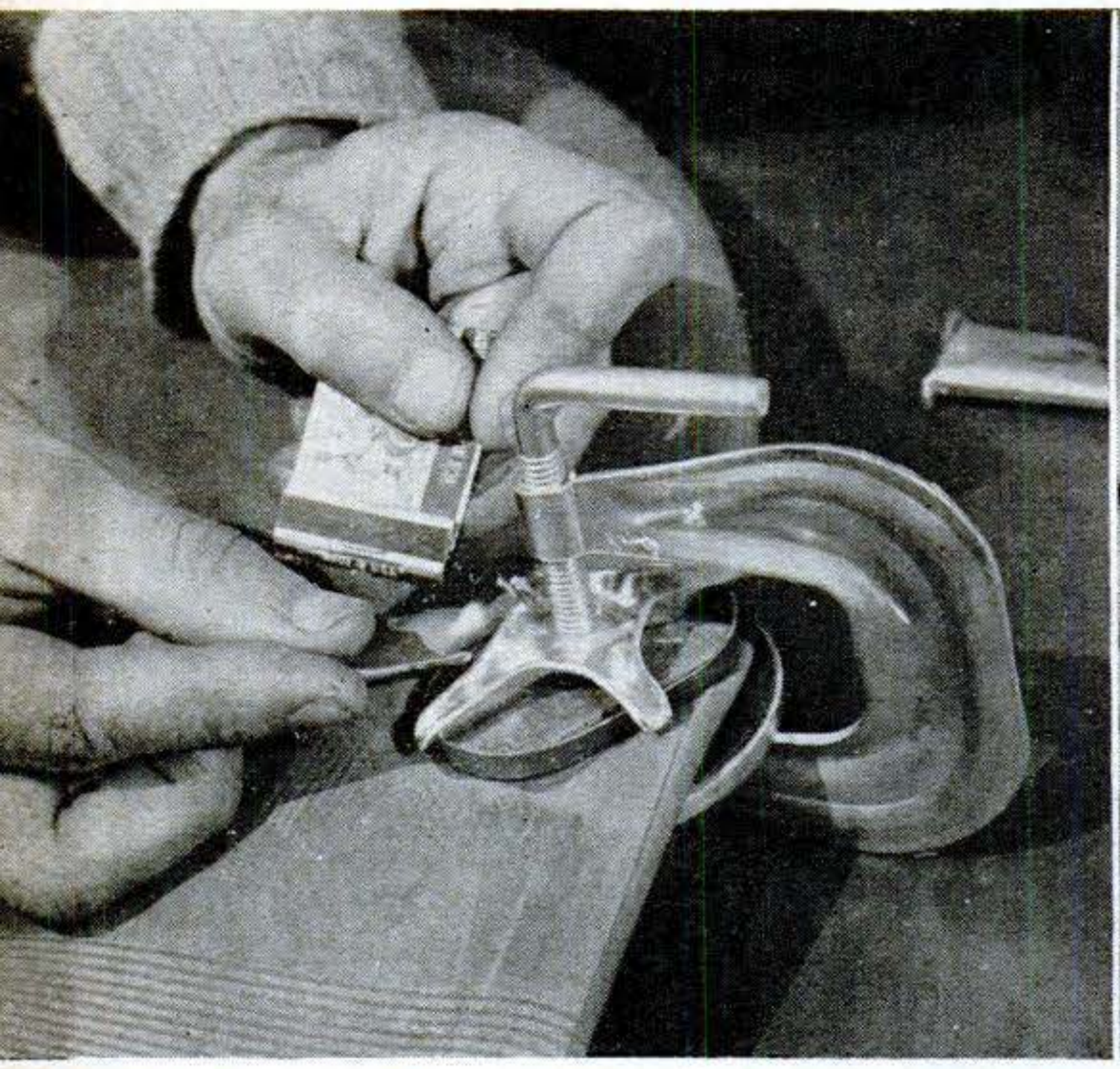
APPLYING A HOT PATCH



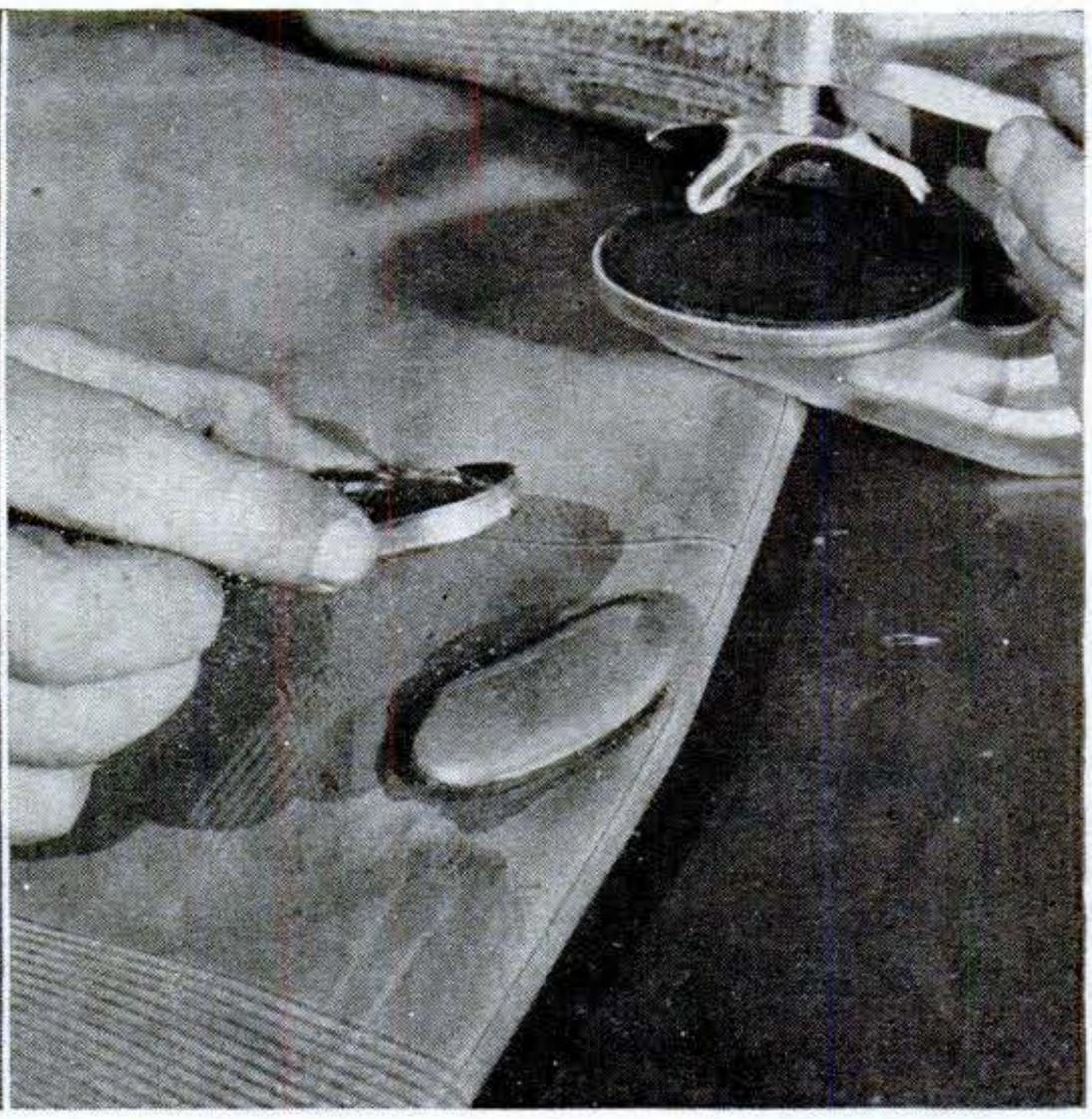
1. Patch, being uncovered above, consists of uncured rubber stuck to metal pan that holds heat powder. First, trim the injury and buff and clean the rubber as for a cold patch.



2. Cut gum from extra patch, cement edge of hole, and press in gum level with tube surface (inset) if injury is large. For strongest repair, cement buffed area of the tube before patching.



3. Center patch over injury after peeling off protective cloth, clamp vulcanizer on tube, and put a flaring match to combustible powder.



4. Remove assembly when pan is cool to your touch. Since repair gum deteriorates, it's best to use patches less than two years old.

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facturers claim a good number of tube failures can be traced to the lack of such knowledge.

For best results, proper installation must include:

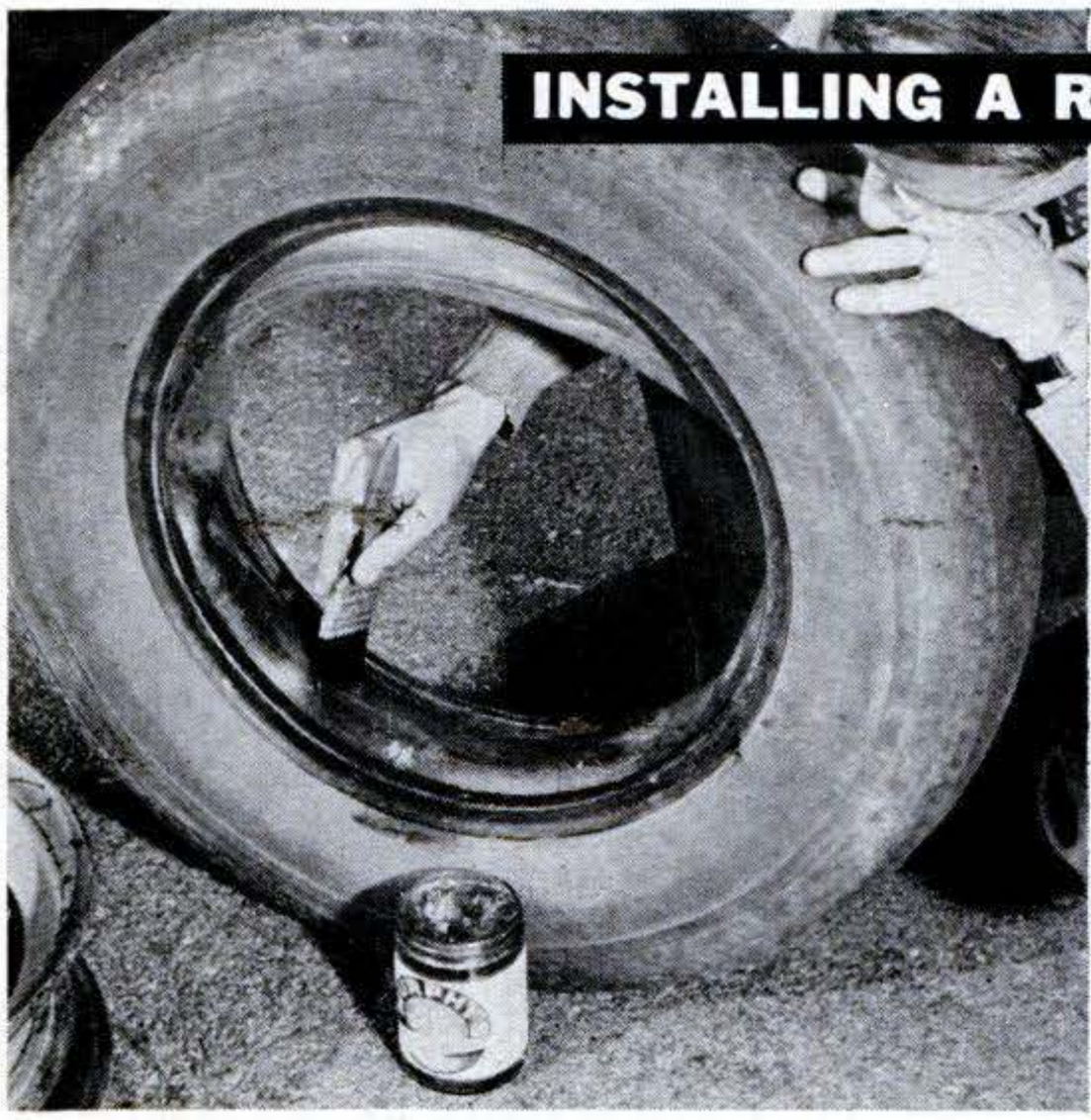
- Lubricating the tube with a vegetable-oil soap.
- And seating it properly by following an inflation-deflation-inflation routine.

You may encounter servicemen who will tell you these steps are not necessary. It is true that some tubes slapped in by the old procedures may not give trouble. But others will.

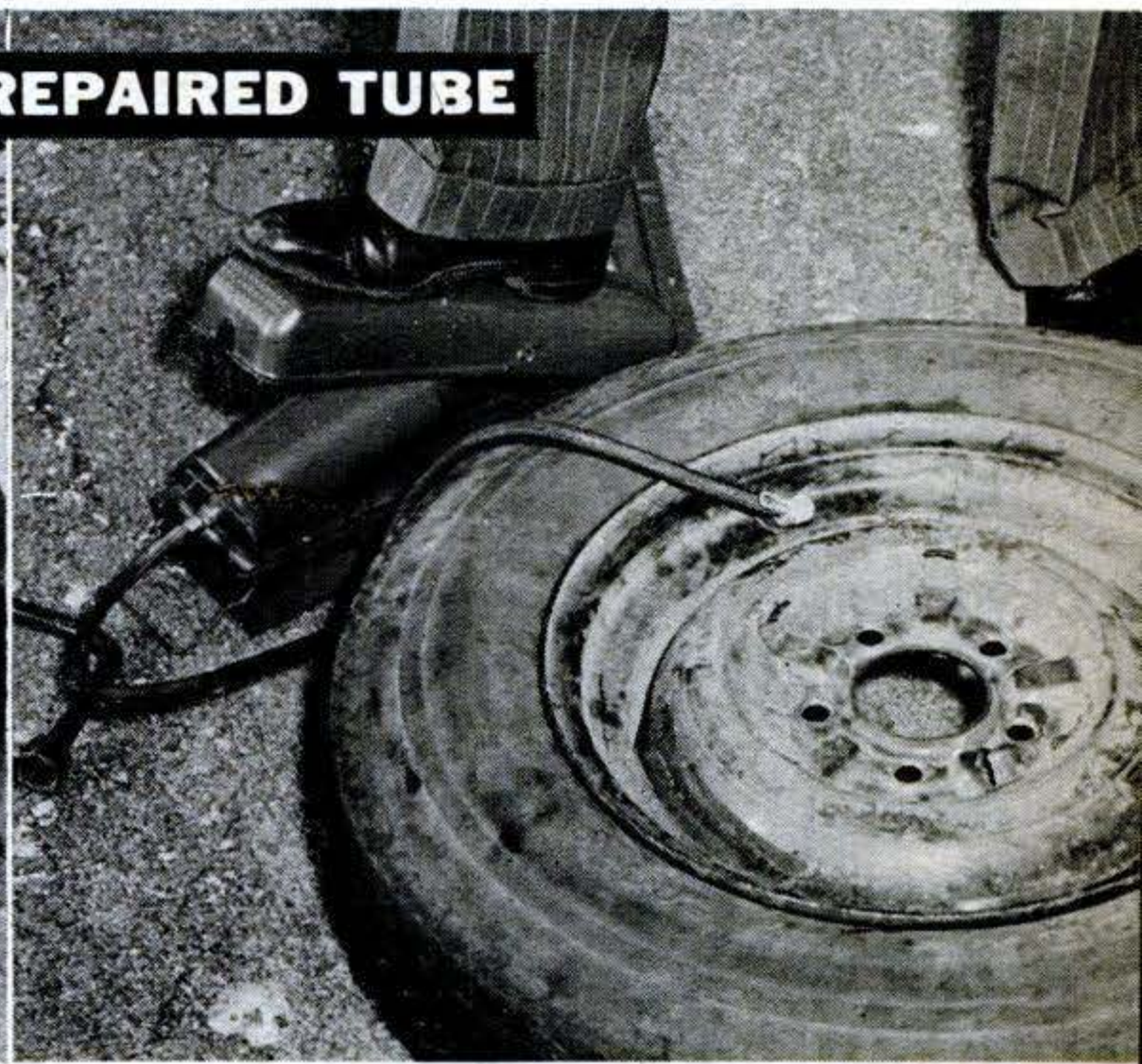
Since small shops often do not have vegetable-oil soap, it will pay you to buy and carry your own, Murphy's Oil Soap for instance. Most hardware stores have it. Powdered lubricants, incidentally, are not an acceptable substitute for the soap.

For roadside repairs, you also need a hand pump and a couple of tire irons. END

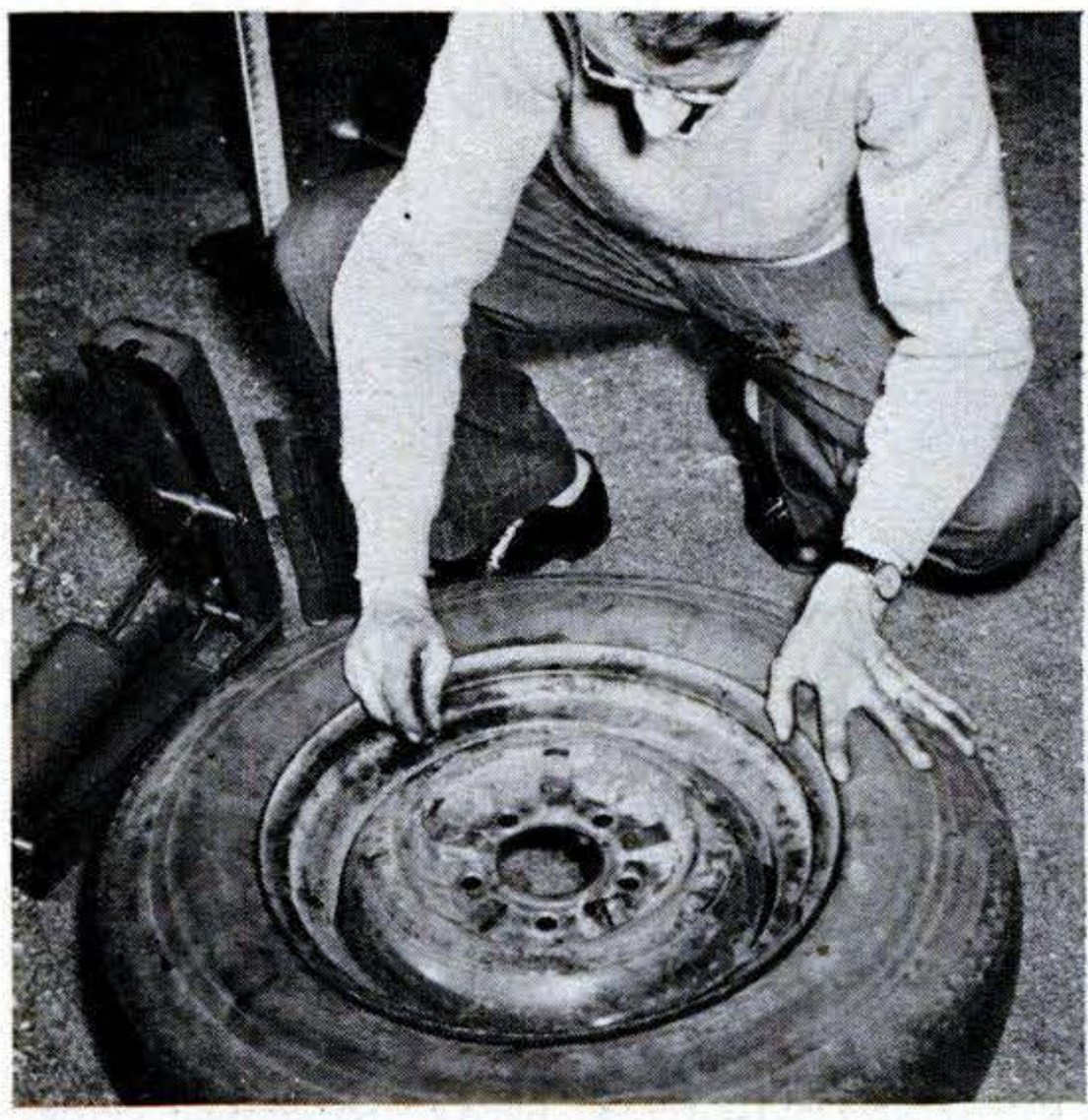
INSTALLING A REPAIRED TUBE



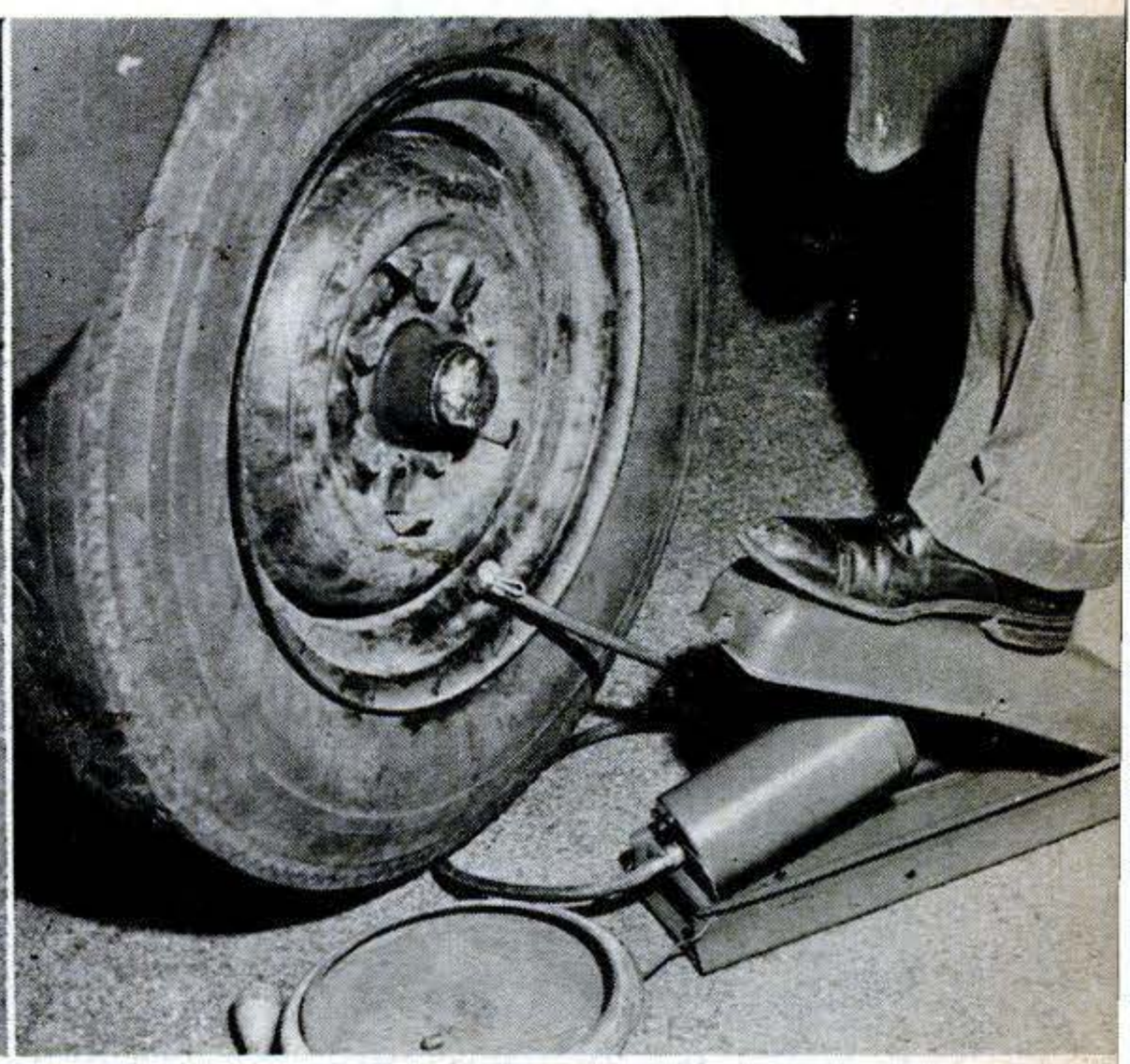
1. Brush vegetable soap on visible part of the tube and on tube and tire for about 2″ down inside casing. Be sure to clean any gritty dirt from tire and tube before installing tube.



2. Inflate fully after mounting tire on rim. This is first step in inflate-deflate-inflate routine and serves to seat beads firmly, but tube may be stretched excessively in spots.



3. Deflate completely. This lets tube even out. (Use these steps too if you remove and install tube by the one-bead-off-rim method.)



4. Inflate the tube again—and you are finished. That's a lot of work, if you're using a hand pump—but the experts say it'll pay off.

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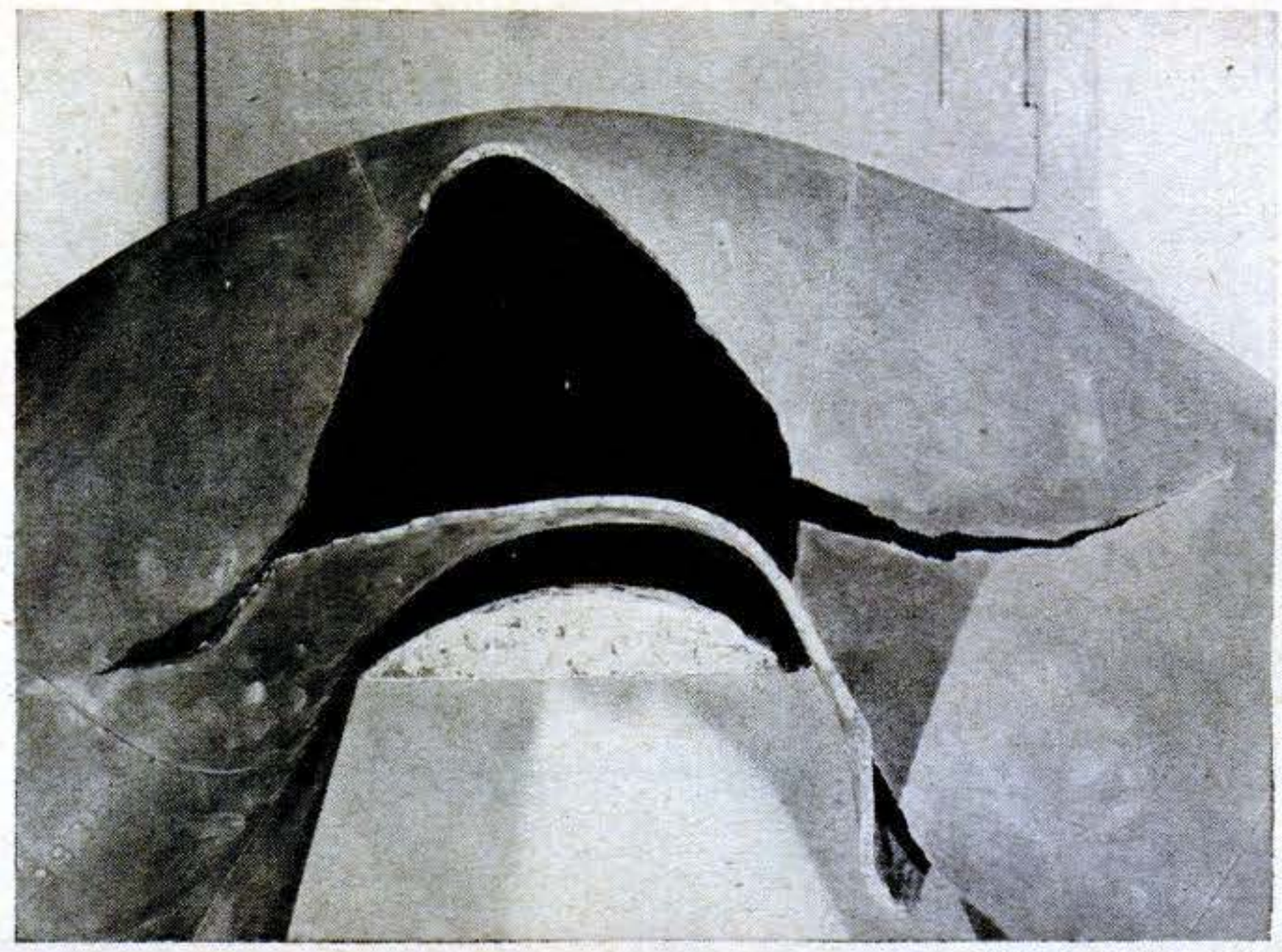
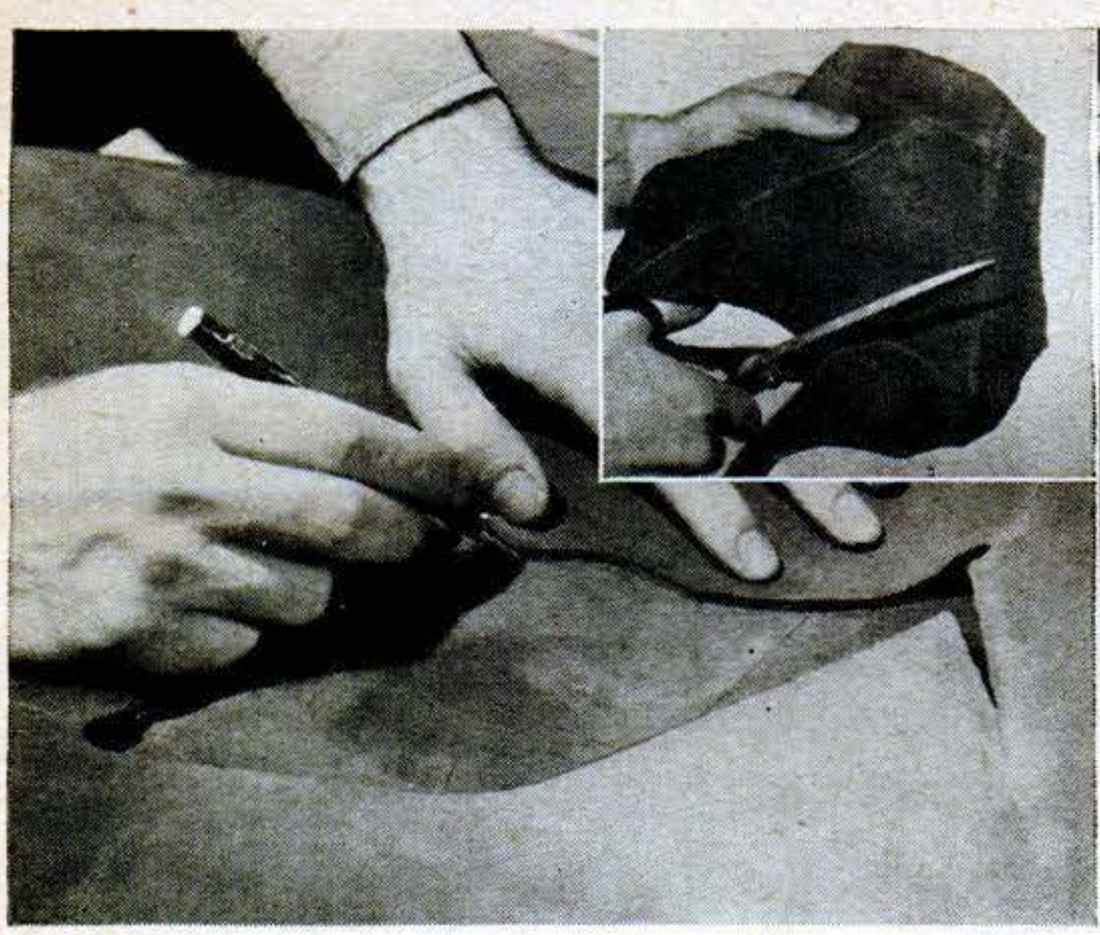
You Can Save This Tube, Too

Instead of junking badly damaged tubes, take them to a well-equipped tire shop. An inlay patch or resplicing can often return them to service. For both types of repairs, the service man cuts pieces from a second damaged tube. Photos below show how an inlay patch is applied.

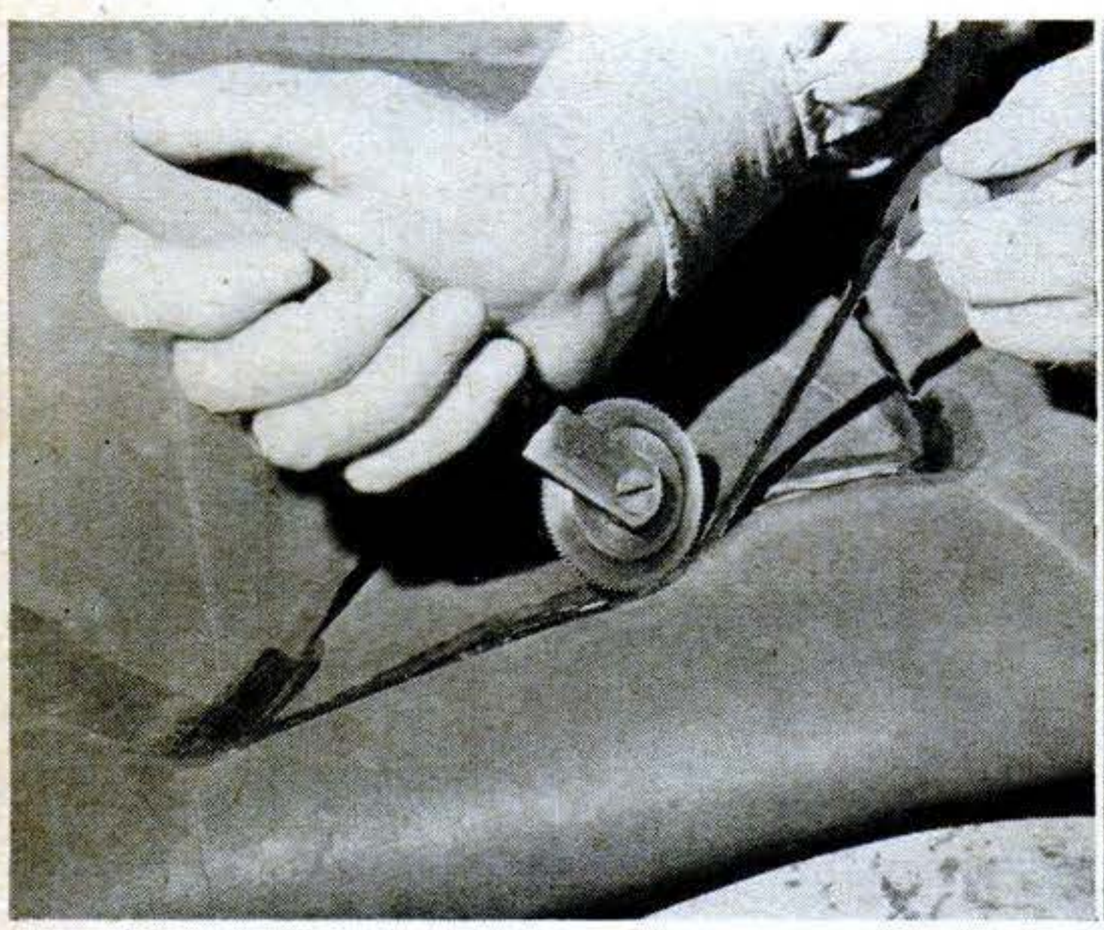


Photos by Firestone



1. Inlay patch is marked on rubber cut from a discarded tube by tracing around the trimmed edges of the injury. When patch is cut (inset), shears are tilted to bevel edges.

2. Edge of cut is buffed to a bevel. A Carborundum wheel on flexible shaft makes this an easier job. Edge of inlay also is buffed. Rubber along all edges is then roughened.



3. Two strips of uncured gum are worked into V-channel between patch and tube, one on top of the other. Buffed and roughened areas are first cleaned and then cemented.

4. After heat-curing, here's how repair looks. When repair is done by resplicing method, a tubular section is salvaged from a discarded tube and welded to cut ends of damaged tube.

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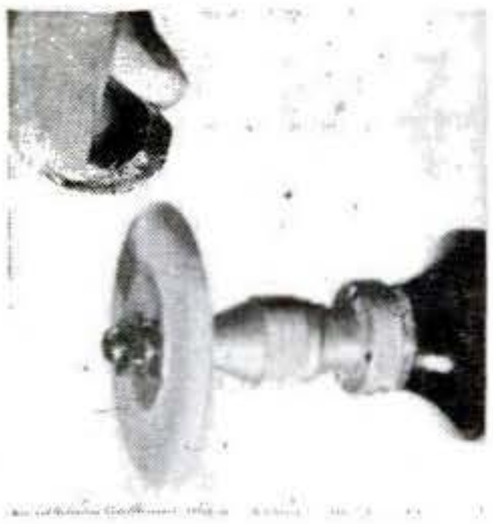
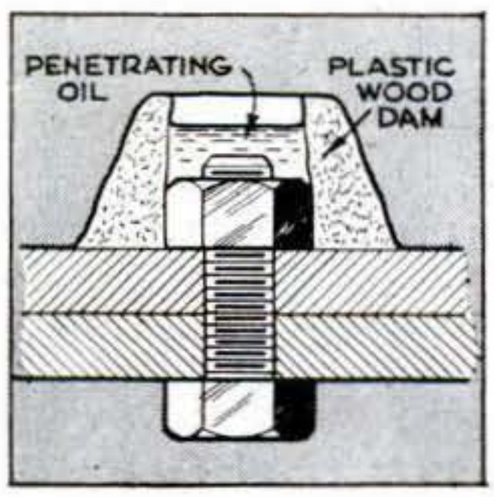
Eraser Makes Polishing Wheel

A TYPEWRITER eraser, mounted on a bolt and chucked in a hand grinder or a drill press, makes a good polishing wheel for small metal parts. Soft, yet just gritty enough to clean up the metal rapidly, it works fine on jewelry and small model parts. But don't use it for plated or highly polished work.—*R. E. Hancock, Portsmouth, Va.*



Plastic Wood Helps Unfreeze Bolts

BADLY rusted bolts and setscrews can often be loosened with penetrating oil. But if the oil is just poured on, not enough of it soaks in to do any good. To do the job right, I build a dam of composition wood around the rusted part, then fill the dam with oil, covering the bolt or screw. The dam holds the oil in place long enough for it to soak into the parts.—*M. L. Rhodes, Knightstown, Ind.*

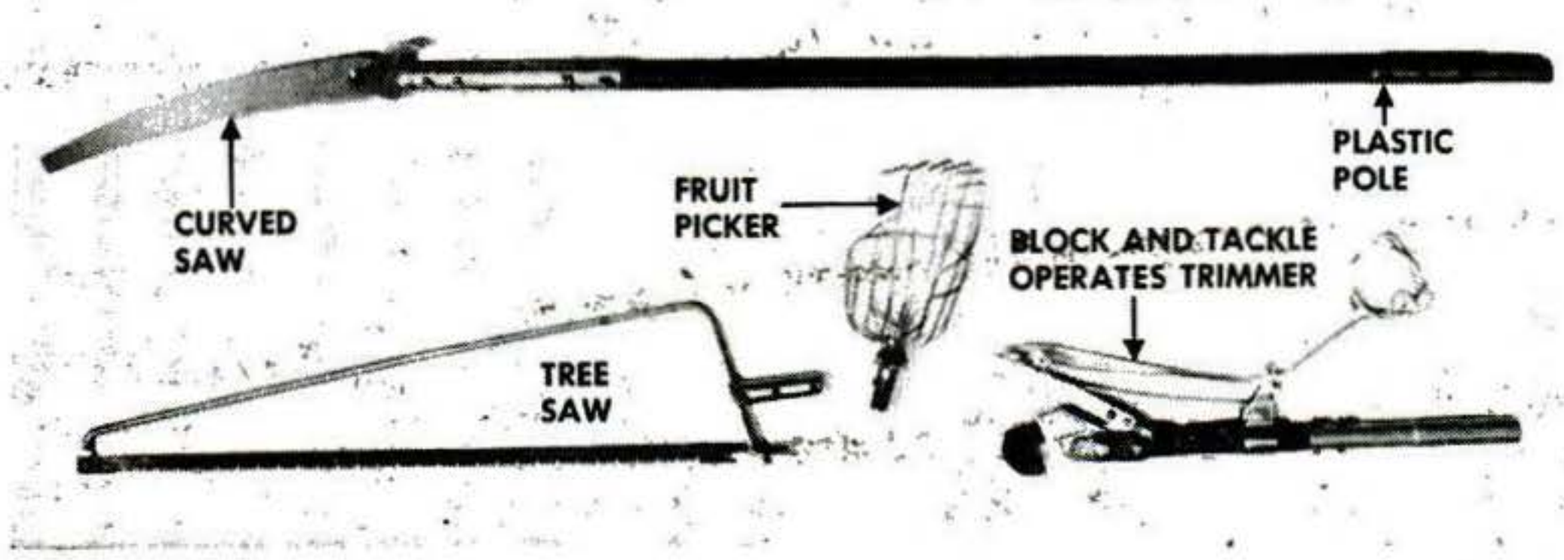


Weather Vane Decorates TV Antenna

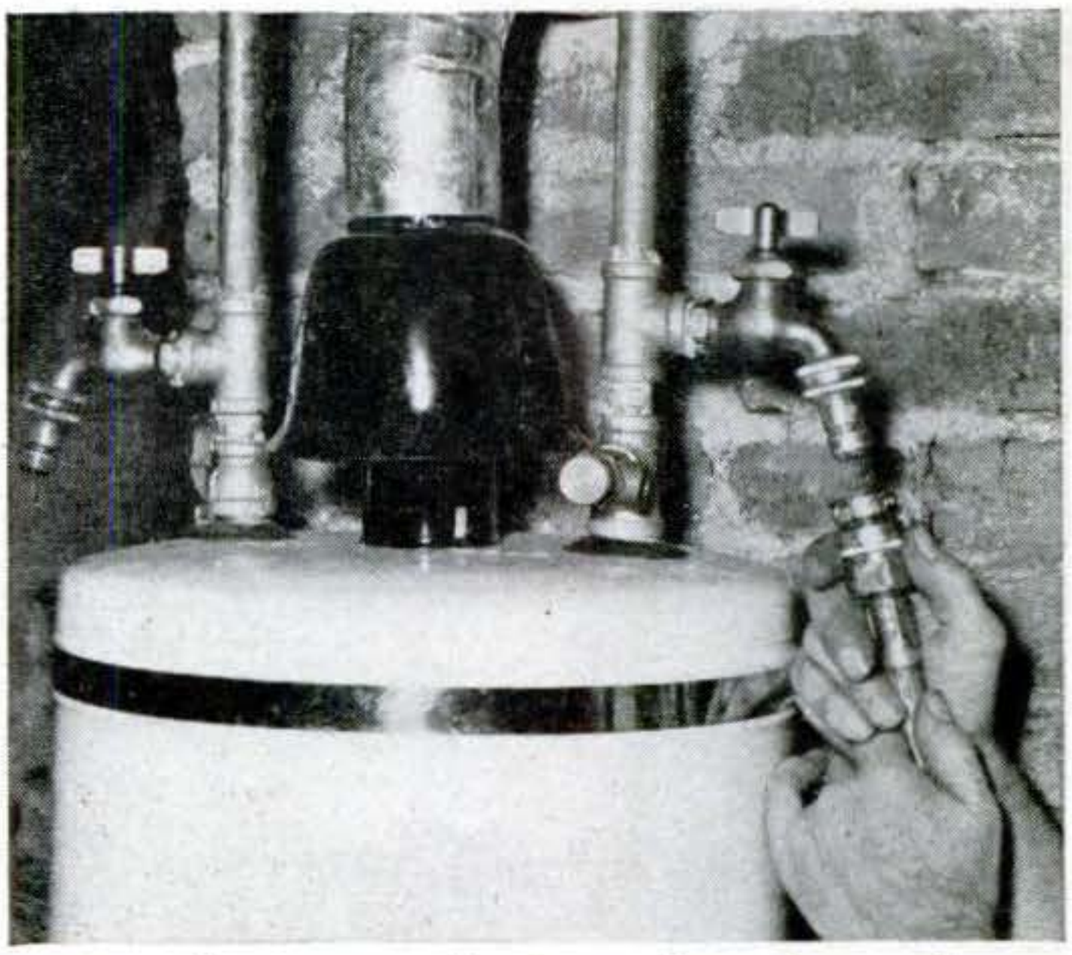
VIDEO waves aren't the only things riding through the air these days. That old lady and her broomstick keep them company on this new combination weather vane and antenna. The idea is to make masts on modern homes less unsightly and give them an extra function. The oval antenna is about half the size of conventional high- and low-band dipoles but has about the same efficiency. The Antenna-Vane is made by Zenith and retails for about $40.

Insulated Pole Protects Tree Pruners

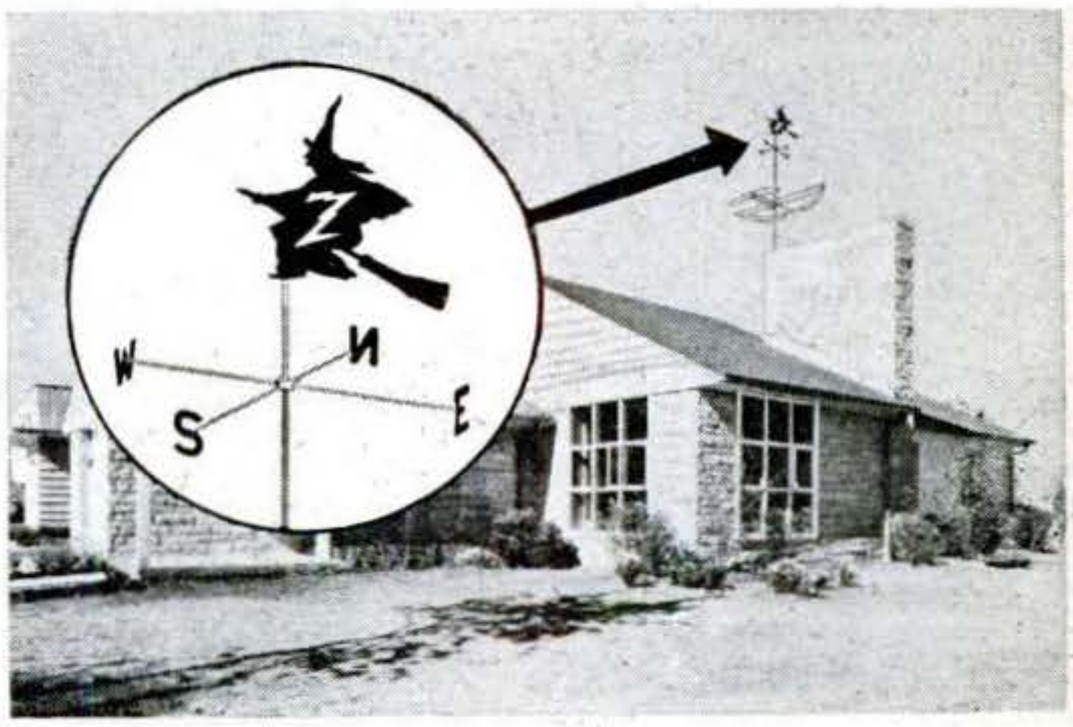
TO GUARD against shock when pruning trees near power lines, the J. B. Sebrell Corp., of Los Angeles, sells a four-foot plastic pole section. An entire pole can be built up by joining insulator sections, or the plastic section can be combined with aluminum pieces to make poles up to 60 feet long. These units, one-third the weight of wooden poles, and other pruning accessories are shown in the photo at left.



Water Heater Provides Running Water



OUR basement had no laundry tubs or other fittings for drawing water. To wash down the floor, clean off storm windows, or do any job requiring water, I had to cart it by the bucket from the first floor. I decided this was one chore too many, added hot- and cold-water faucets to my water heater, and had water right at hand. Snap-on hose couplings and a length of hose with a snap-on fitting solved the water-mixing problem. An extra length of hose with a sprinkler head would provide a shower bath.—*Ivan Grosvenor, Richmond, Ind.*



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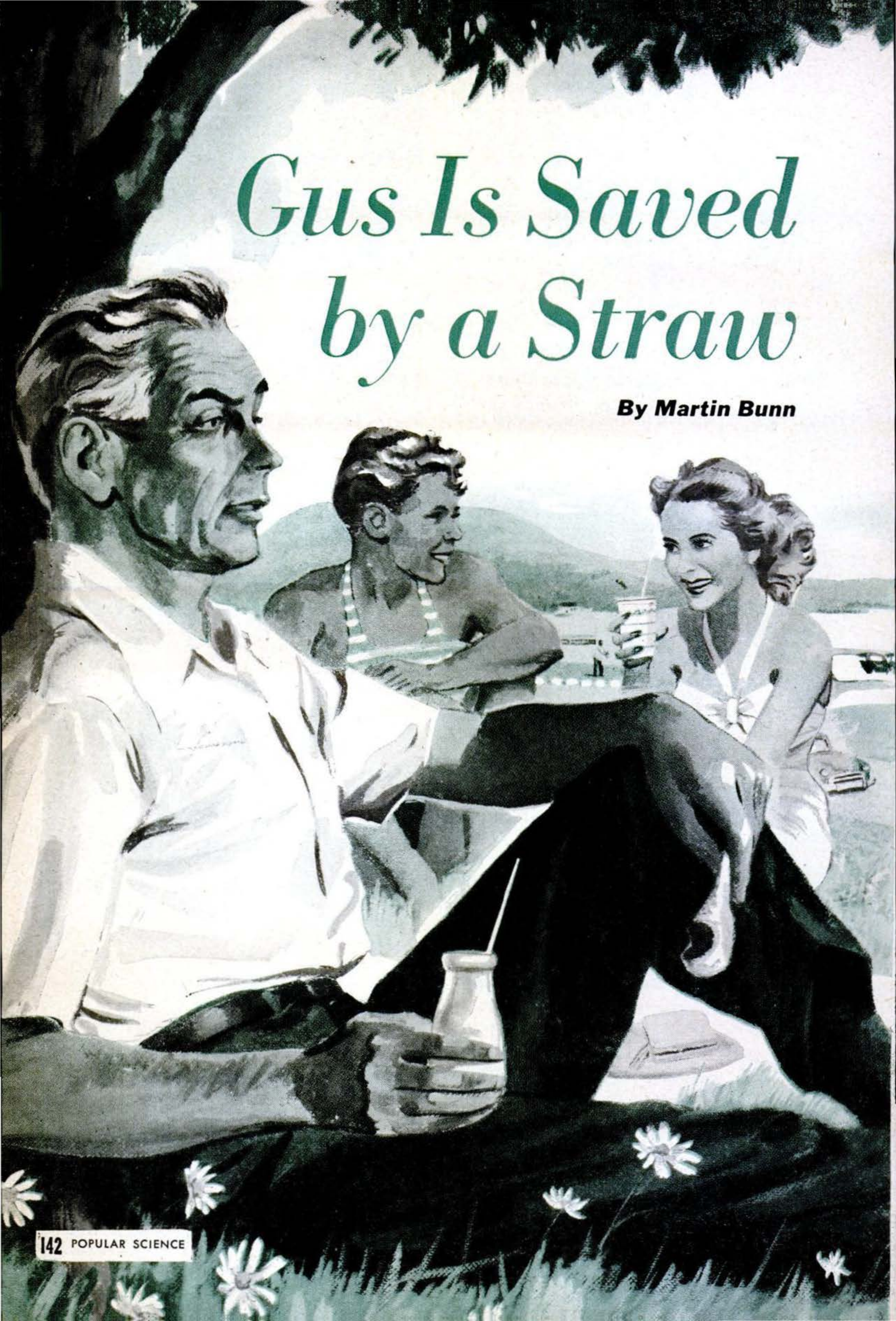


Gus Is Saved by a Straw

By Martin Bunn

A picnic that begins in near tragedy gives Gus a bad time—until he gets an assist from the fair sex.

GUS WILSON pushed the old sedan up to the 50-m.p.h. speed limit and held it there. They were late. He mumbled something about women who keep men waiting, but the silence from the rear seat indicated that its two youthful occupants had other things on their minds.

"Hey," Gus called. "You two still back there?"

"Huh?—oh, sure," said Stan sheepishly, "Jane and I are just checking over the food she brought to make sure we haven't forgotten anything."

Gus never cared much for picnics, but this, he had to admit, was different. It was the annual summer outing put on by the local American Legion post, and the whole town turned out. There were swimming, canoeing, games, and—most important to Gus—fishing. And the Women's Auxiliary set up stands and sold sandwiches, milk, and pop to supplement the box lunches people brought.

They Even Ordered the Weather

Gus had had so much fun at last year's outing that he decided this time to bring along Stan Hicks, his helper at the Model Garage, and Stan's girl friend, Jane Stevens. And what a perfect day for it, he mused—not even the elements would dare defy the Women's Auxiliary.

"Are we going to be late, Mr. Wilson?" asked Jane.

Just like a woman, thought Gus. Keeps you waiting, then wonders why you can't get there on time. "We are," he said with a good-natured gruffness, "if we don't get around some of this traffic."

With that, Gus pulled out to pass. But as he did so, the car in front also pulled out. Gus decided not to follow and eased back in. As the car ahead pulled abreast of the next car, it suddenly started to slow down and fall back.

"That fellow better pass or pull his nose in quick," commented Gus, as he nodded toward a giant trailer truck bearing down in the opposite lane.

As they watched, the car kept dropping back, then swerved crazily, ducking in just in time as the big 10-wheeler roared past.

"Yipes," yelled Stan, "that was a close one."

"Too close," muttered Gus. "What do you suppose that fool was trying to—"

"Say," interrupted Stan, "isn't that the Bell's car?"

"By golly you're right," agreed Gus, "and they're stopping. We'd better see what the trouble is."

Gus Is Puzzled, Too

Gus braked to a halt ahead of the disabled car, and the trio got out. As they walked back toward it, they saw Ken Bell, a past commander of the local Legion post, and his wife, Bess, who is the present head of the Women's Auxiliary. Both were out of the car, and they looked shaken.

"Gus Wilson!" exclaimed Ken, as he recognized him. "Did you see that?"

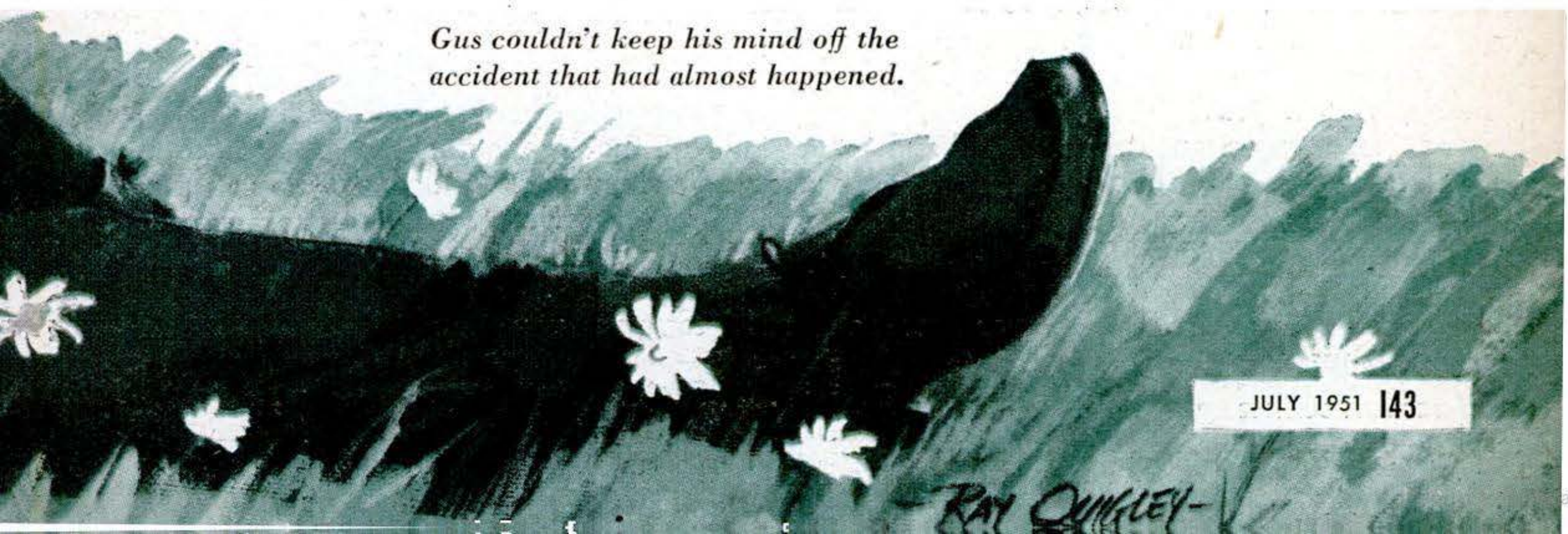
"Saw it? Why, I almost got caught in it with you. What happened?"

"I don't know. She ran all right as long as we didn't try to make any speed, but when I stepped on the accelerator just now to pass, she started to cough and spit, then just quit cold."

"Let me try it," suggested Gus. As he slid under the wheel, he turned the ignition key and pushed the starter button. The engine started easily enough, but as he tramped down harder and harder on the accelerator, it began to miss. Finally, it died.

"Sounds like it's not getting enough gas," put in Stan.

"Or maybe too much," replied Gus, turn-



Gus couldn't keep his mind off the accident that had almost happened.

ing the ignition off. "In any case, this narrow road is no place to fuss with a balky engine. We'll tow you to the picnic grounds, Ken. It's only a few miles."

"That would be swell of you, if you would," Ken said, gratefully. "Bess, here, was supposed to be there in time to supervise the setting up of the refreshment stands, and I've been elected to umpire that softball game we have every year between the World War I and World War II vets."

It didn't take Gus and Stan more than a few minutes to rig the tow cable that Gus always carries in the trunk of his car. So, with Gus driving his car and Stan piloting the Bell's sedan, the procession soon got under way. About twenty minutes later, both cars were safely parked at the picnic grounds.

No Fishing Yet

"Thanks a million, Gus," said Ken Bell as his wife hurried off in the direction of the refreshment stands. "I hate to ask it of you, but after the ball game this afternoon would you help me get this car in some sort of shape for the drive home?"

"Sure thing," said Gus. "We'll get you home one way or another."

"Well, Jane, how about that dip before we dig into that lunch you brought?" asked Stan after Ken Bell had left.

"Good idea," put in Gus. "You kids get into your bathing suits. I'll meet you for lunch."

"What are you going to do, a little fishing?"

"Oh, I'll get to that too, but right now I think I'll have a look at the Bell's car."

"Can I help?"

"Not a bit. You and Jane go ahead and enjoy yourselves. When you're ready for lunch, give a yell."

As Jane and Stan strolled off hand-in-hand down the path that led to the bathing pavilion, Gus got into the Bell's car again and started the engine. It acted just as it had before, started easily but then coughed and finally quit when the power was applied. It just wouldn't take gas.

"Humph," Gus grunted to himself as he got out and opened the hood. "Could be any one of a heap of things. Might as well start with the distributor and ignition."

No Fishing, No Repairs Either

Forty-five minutes later, after also checking the fuel lines, fuel pump, and carburetor, Gus was just where he started. He thought of the kids down at the swimming hole and wished he hadn't been so hasty in telling them to run off. He needed Stan to help. Or maybe he was just annoyed at his own inability to find the trouble.

At that moment, Stan returned from his swim. "Say, how about some lunch? This is supposed to be a picnic, you know, not a branch of the Model Garage."

"Suppose I might just as well," agreed Gus reluctantly, taking out his disgust on a piece of waste as he cleaned his hands. "I'm sure not getting any place here."

Jane had everything ready. A neat red-and-white checked tablecloth was spread out on the ground under the shade of a big oak tree. On it were homemade sandwiches, fried chicken, pickles and olives, hard-boiled eggs, apple pie and cold bottles of milk complete with straws.

When Gus saw the food that Jane had brought his eyes brightened. "Stan," he said, "hang onto this gal. She knows the way to a man's heart."

Jane took a bow.

"Just pull yourself up a piece of grass and sit down," Stan quipped, picking up a paper plate and draping a paper napkin over his arm, waiter fashion. "What'll you have?"

Even a Chicken Leg Doesn't Help

Stan gave Gus a well-filled plate, but as the veteran mechanic sat there under the shade of the tree munching on a chicken leg and sipping his milk he couldn't quite get his mind off the accident that had almost happened. Sure, he knew that without his garage test equipment he hadn't been able to give everything a complete and

[Continued on page 194]

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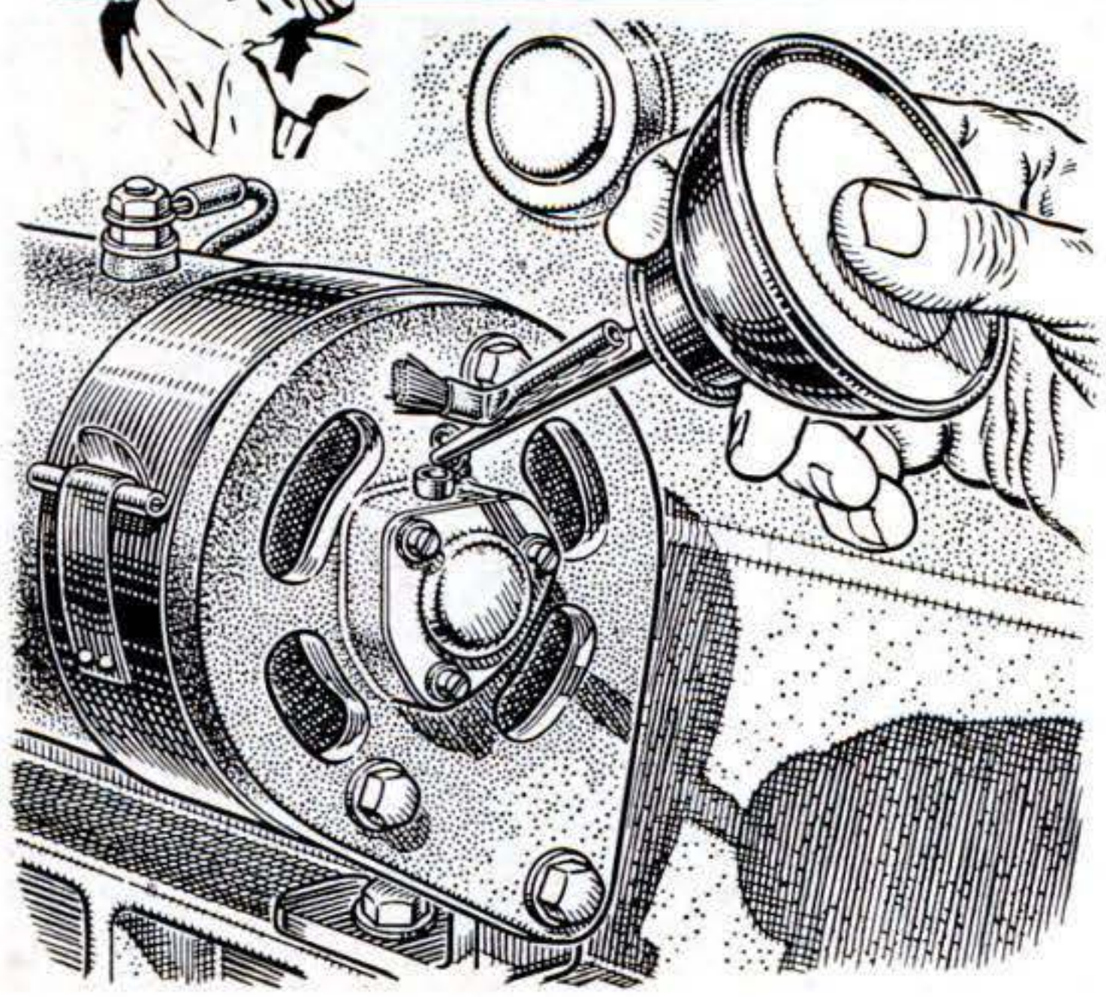
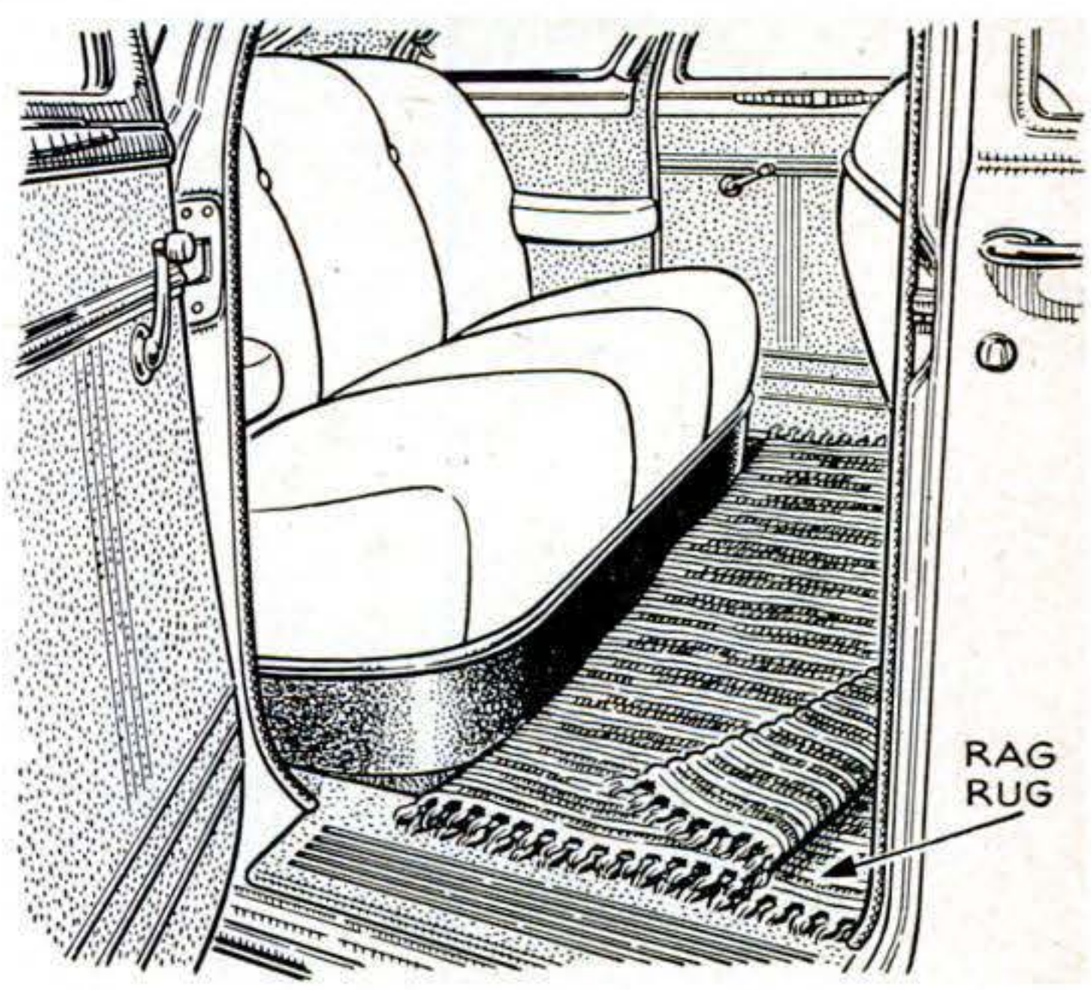
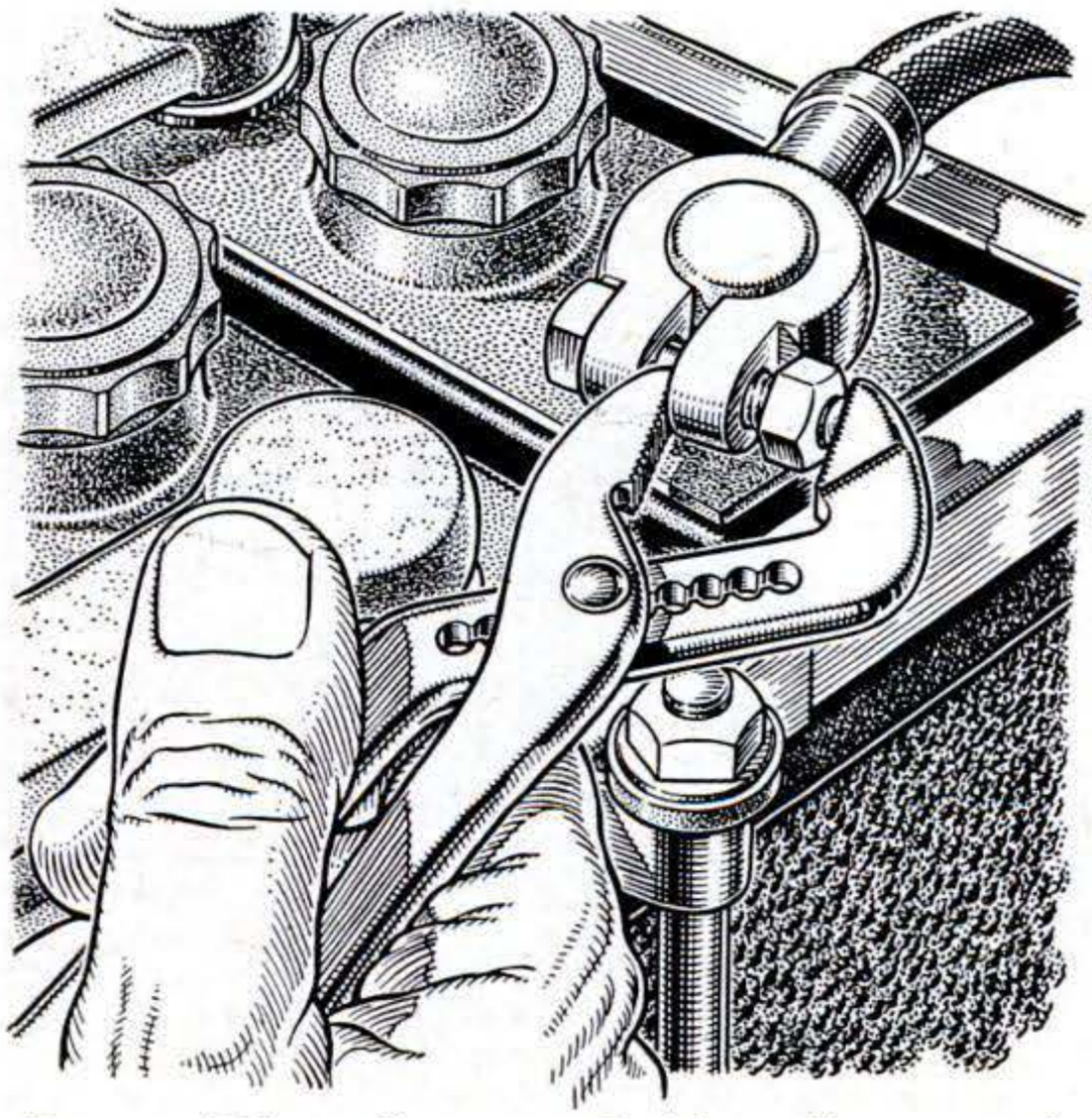
Hints from the Model Garage



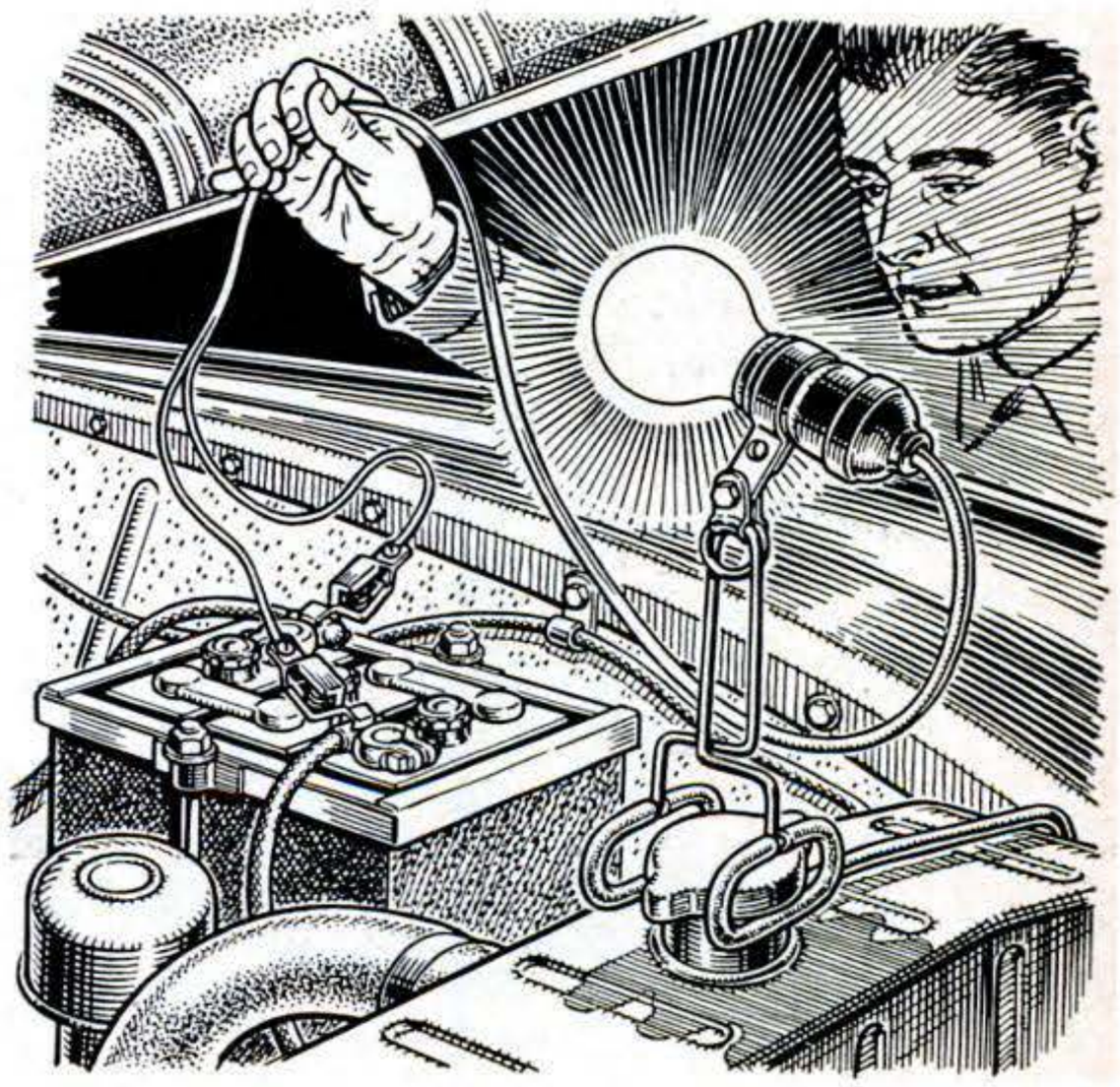
Brush Cleans Oil Holes. To clean out oil holes and keep grit out of bearings, solder a bent mucilage brush to the spout of your oilcan. A few swipes of the stiff brush will sweep away accumulated grime before you squirt oil into the holes.



A Tip for the Lady of the Family. Put a couple of old rag rugs in the trunk of your car. Then, during muddy weather, throw them over the back-seat pile carpeting. Clean the rugs by throwing them into the washing machine.



Pump Pliers Loosen Cable. If you own a pair of water-pump pliers, they can do double duty in removing battery cables. Loosen the cable clamp nut about two turns, put on the pliers as shown above, and squeeze and twist at the same time. The jaw of the cable clamp will loosen on the terminal as you squeeze the pliers.



Trouble Lamp Easily Made. Most auto-supply stores carry frosted six-volt bulbs in 15- and 25-watt sizes with a base like ordinary house bulbs. With one of these, you can quickly make an efficient trouble lamp for your car. A standard socket, some sort of clamp, wire, and alligator clips are all you need.

Turn the page, please, for eight more auto hints.

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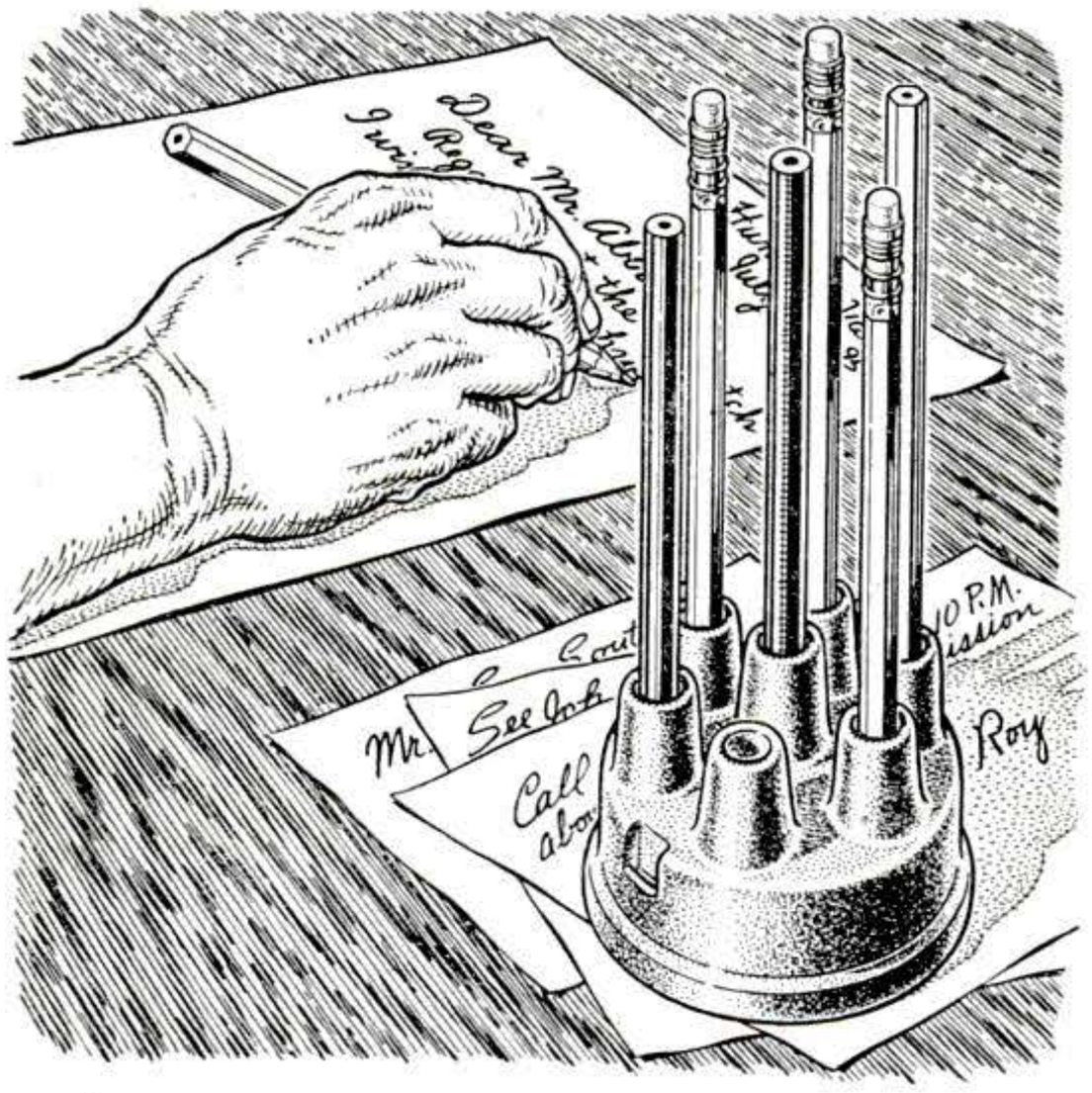
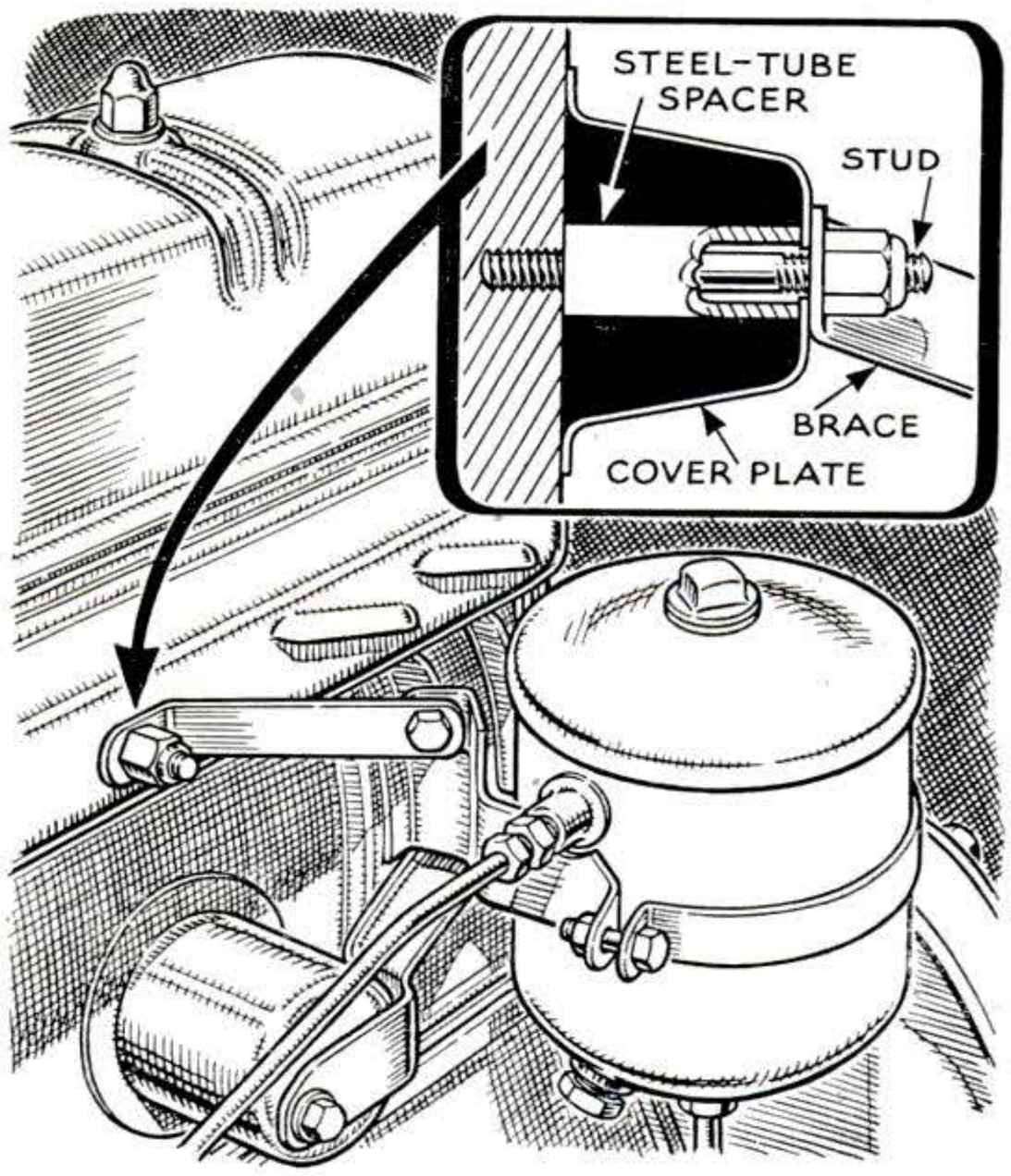
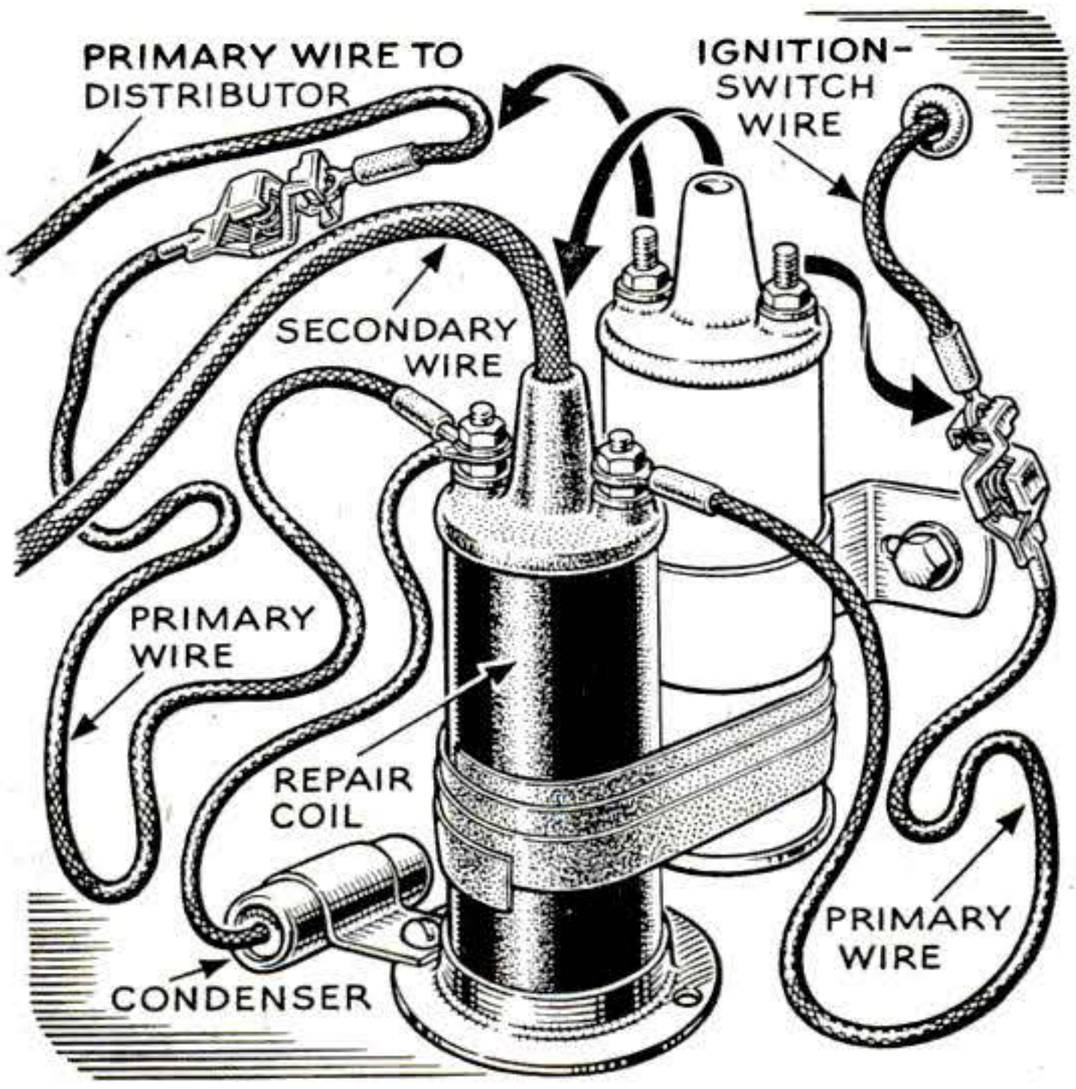
MORE Hints from the Model Garage



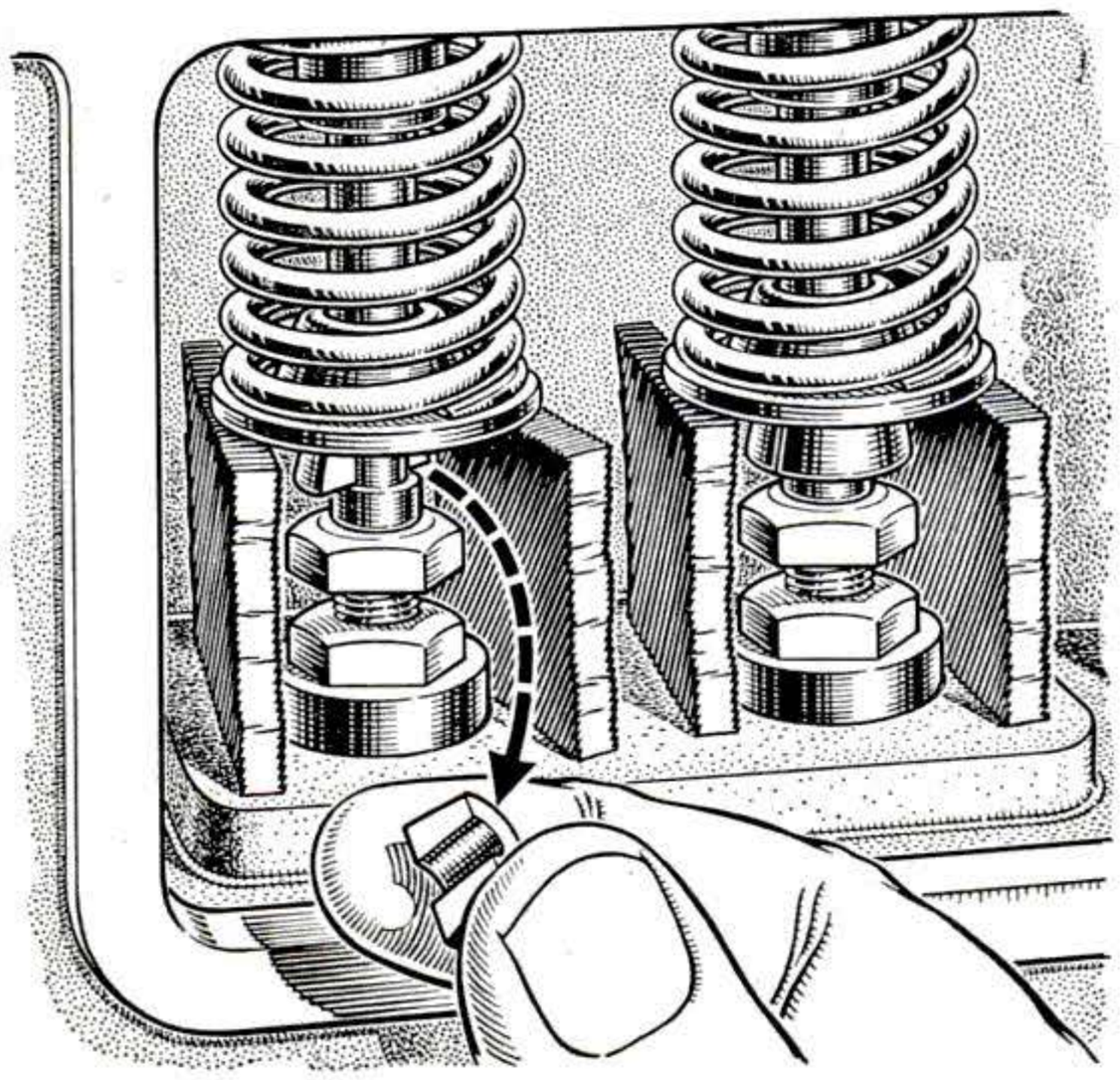
For Your Paper Work. One garageman we know uses an old distributor cap on his shop desk as a combination paperweight and pencil holder. The holes are deep enough to hold the pencils so they won't wobble. Better clean the cap.



Spacer Anchors Oil Filter. On some late-model Buicks, the oil-filter bracket is fastened to a cover-plate stud. A metal spacer slipped on the stud behind the cover provides a solid base against which to tighten the nut. This makes it less likely to rattle.



Save a Towing Bill. A bad coil or condenser accounts for many breakdowns. One veteran mechanic takes this spare coil and condenser unit on road calls, and he reports it often enables him to drive the car away. Carried in the car, such a unit may save any motorist a towing bill. Ground the condenser shell.



Removing Valve Keys. If you lack the proper lifter, here's how you can remove valve keys from an L-head. Hand-crank the engine until the valve opens and slip two flat files (you need a nonslip surface) on edge under the spring. Crank engine to lower valve, and you can pull out the keys. It works in replacing them, too.

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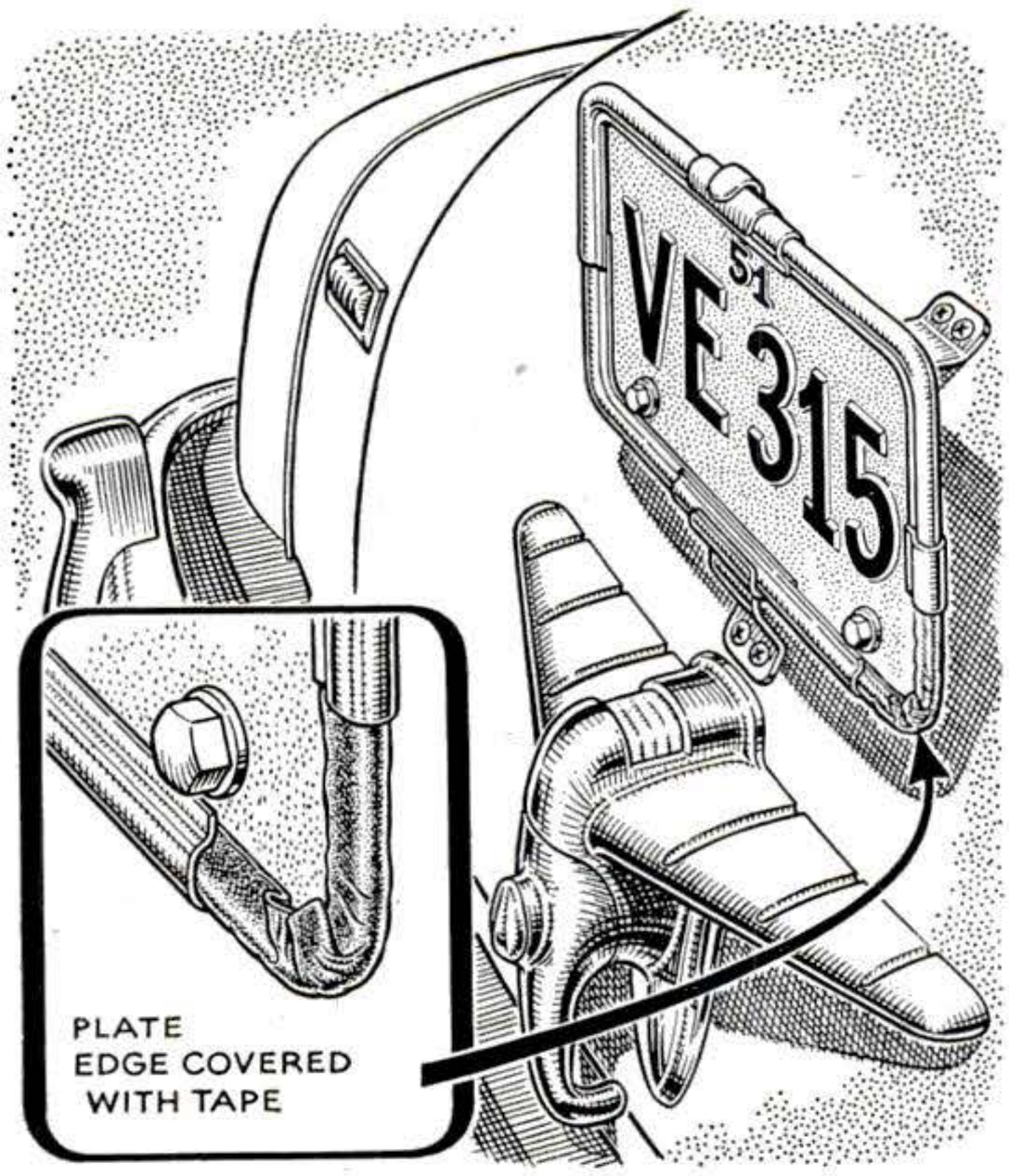
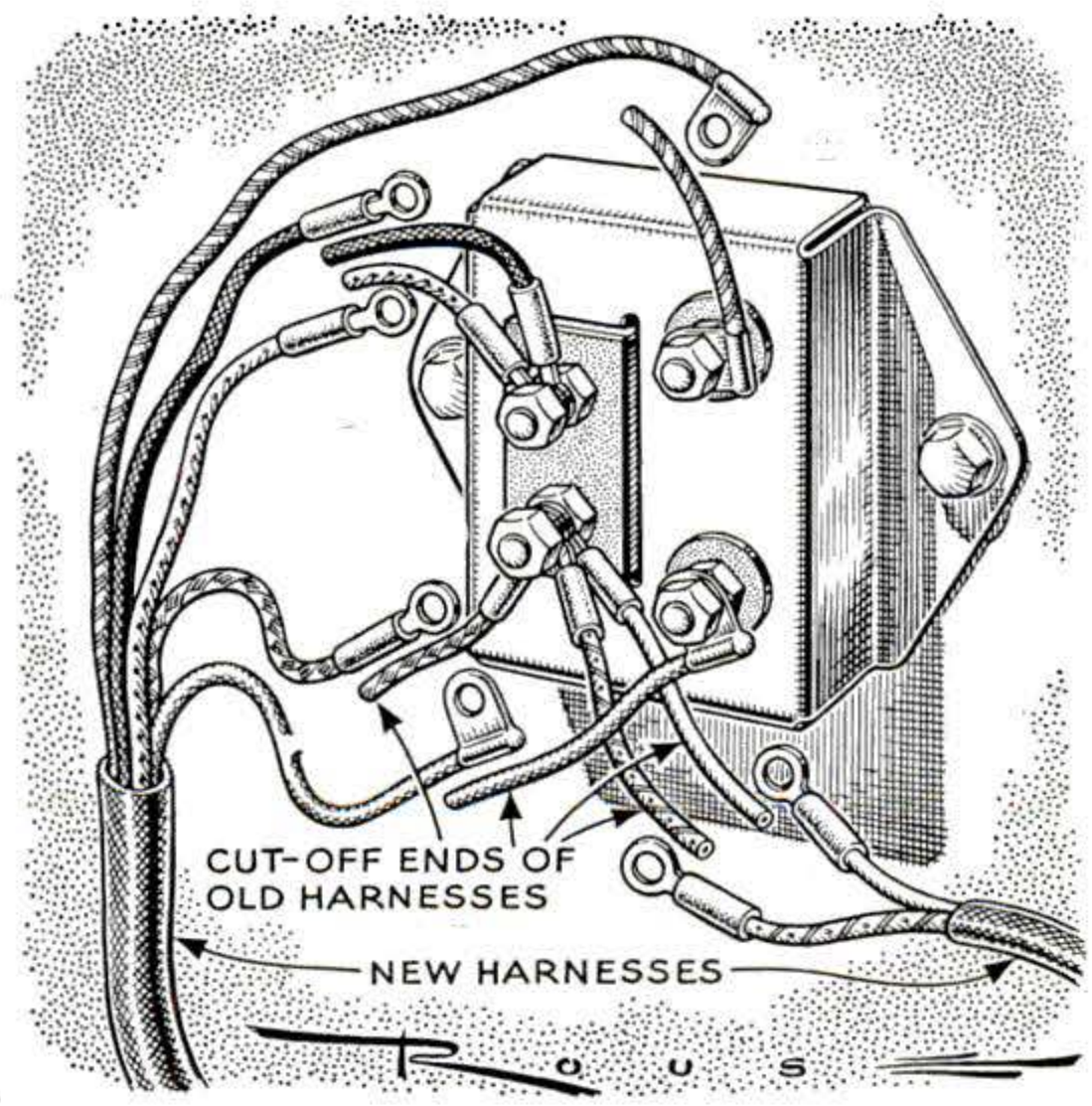
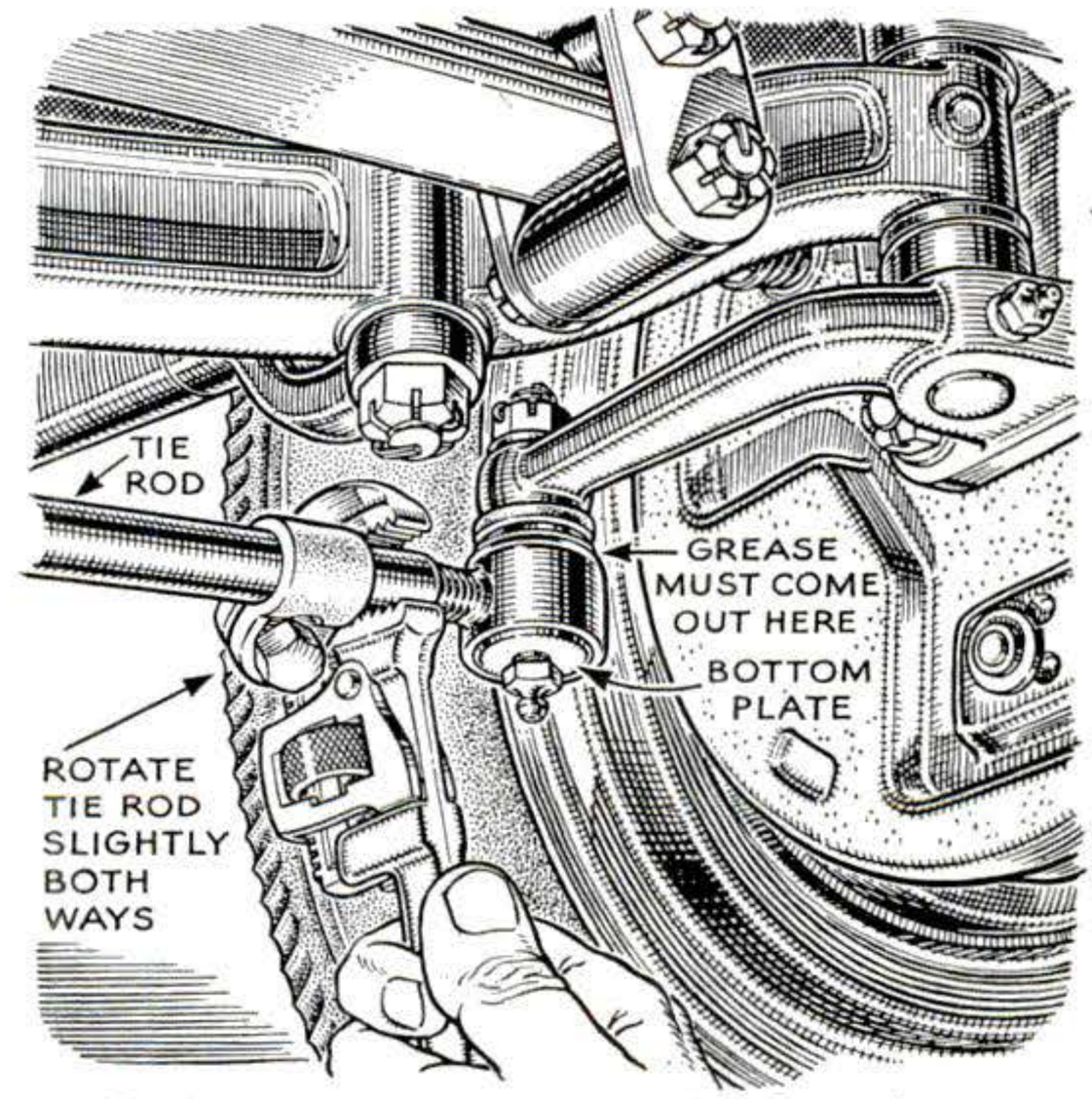


Tape Tightens License. If a license plate rattles in an ornamental frame, you can make it fit snugly by placing friction tape around the edge of the plate. The tape won't be noticeable if you fold the excess over the back.

Keep a Record of Your Paint. If you repaint your car, it's a good idea to record the paint name and number on the underside of the trunk lid. Then if touching up is ever needed, you will find it easier to get a good match.



Out With Those Old Wires. You can install a new wire system in a car easier and faster if you first cut the old wires a couple of inches from the terminals. Then remove the old harness and install the new. Finally, use the color code on the old wire stubs as a guide in attaching the new ones. Remove one stub, then attach new wire.



Twisting Makes Grease Go In. If grease does not come out at the indicated point when you are lubricating tie-rod ends, put a pipe wrench on the rod and twist it gently, first one way and then the other, until grease appears. Never force the grease too much, or you'll drive out or buckle the bottom plate, ruining the end.

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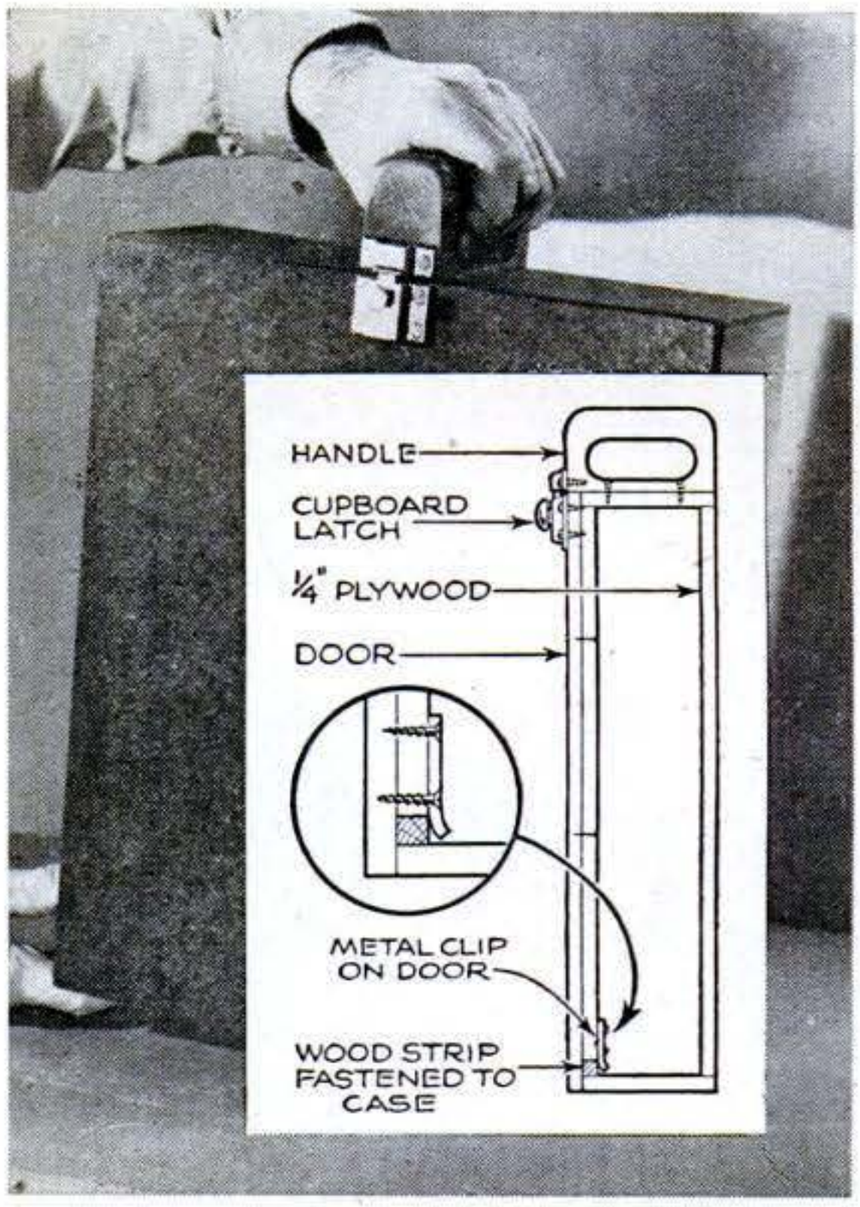
Cleaning materials kept like this make it easy to keep a car spick-and-span. Cloths, blotter, and instructions (see the card below) can be mounted on door of the box.

Building a container that will go into your luggage compartment is a simple job. The latch holds the door to a handle shaped from a block of wood.



This First-Aid Kit Saves Car Fabrics

MAYBE you don't want to cover that fancy new upholstery in your car during the soil-susceptible summer months when hamburger grease, ice cream, and candy are on the rampage. But in that case, you'd better be ready with the antidotes conveniently held in the cleaning kit above.

The case is easily made from plywood or scrap lumber. Partitions, spring-metal clips, and rubber bands will secure the various bottles and other items in place. These should include turpentine, ammonia, carbon tetrachloride, bottle of water (perhaps with a spray nozzle), tin can (for water), foam cleaner, sponge, blotters, clean cloths, dull knife, and a whisk broom.

CLEANING CAR FABRICS

Acids: Wet with ammonia. Rinse with cold water after a few minutes.

Blood: Sponge with cold water.

Candy (non-chocolate types): Wash with hot water. Dry. Sponge with carbon tetrachloride.

Chewing gum: Wet with carbon tet. Remove with knife.

Chocolate: Sponge with warm water. Dry. Wash with carbon tet.

Fruit: Hot water. Dry. Use carbon tetrachloride if necessary.

Grease: Apply carbon tet, rubbing toward center. Or use carbon tet and blotter.

Ice cream: Hot water. Or hot soap suds and cold-water rinse. Dry. Then sponge with carbon tet.

Lipstick: Carbon tet and blotter. Repeat as necessary.

Oil: Same as for grease.

Paint: Sponge with turpentine. When dry, rinse with cold water. If this doesn't work, try lacquer thinner.

Shoe polish (colored): Carbon tet and blotter or cloth.

Shoe polish (white): Wash with cold water. When dry, use brush or whisk broom.

Tar: Wet with carbon tet. Pry off chunks. Remove spots with carbon tet and blotter or cloth.

Water spots: Rub entire area with damp cloth. When dry, sponge spot with cloth wet with carbon tet.

FOR YOUR POPULAR SCIENCE INFORMATION FILE

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Extra Lights for Your Car

A well-aimed spotlight and fog lamps give you greater safety.

By Walter E. Burton

WHEN a ground fog becomes so dense that you can hardly see the highway centerline, a pair of well-aimed fog lamps can be a real life saver. Adding a spotlight to your car can also contribute to safety.

You can often save money by installing these useful accessory lights yourself. Both are available in kit form.

The drawing at the right indicates how a spotlight can make driving safer. Lighting specialists say the moving spot of light will keep your eyes from being drawn involuntarily toward oncoming headlamps and being blinded temporarily. If properly angled from the left side, a good spotlight will not blind approaching drivers.

Fog Lamps Do Not Need Amber Lenses

Amber lenses are not necessary on fog lamps, although you can use them if you wish. Engineers now claim it's a near-the-road position and special beam pattern that give these lamps their value.

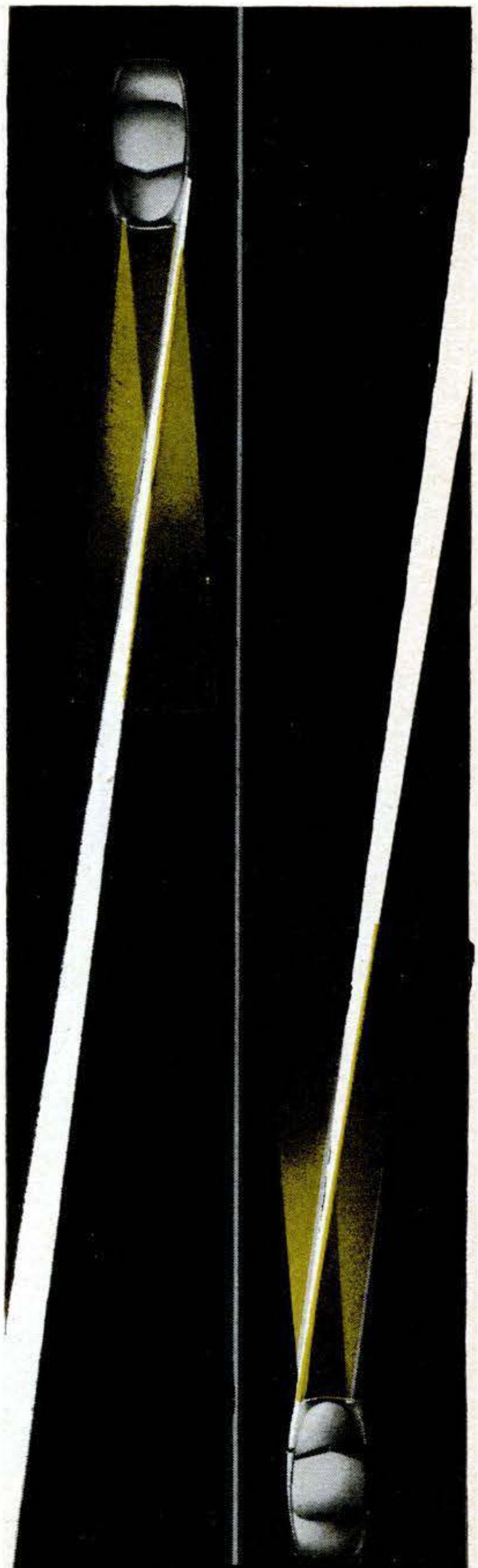
For use in dense fog, fog lamps should be aimed so the tops of their beams strike the road no more than 75 feet ahead of the car. This usually makes it possible to see the road under tough conditions. Another method of aiming is to park the car on a level area with the lamps 25 feet away from a vertical surface. Point them straight ahead and slightly downward to strike the wall 4″ lower than the filament-to-ground height of the lamps.

Both types of lamps are easy to wire. If your car has a two-way ignition switch that can be turned one way to operate auxiliary lights while the engine is not running, you may want to connect the spotlight and fog lamps through it. In any case it's advisable to include a 15- or 20-ampere fuse in the circuit.

Tips on installing both accessory lamps are given on the next two pages.

Check the state regulations before you install or use a spotlight. In *some* states:

- You can use it only in genuine emergencies;
- You can install only one;
- A roof-top mounting is restricted to police cars, public utility trucks, and similar emergency vehicles.



A spotlight can help you drive — as well as locate street signs and house numbers. On an unlighted highway, focus it on right-hand edge of pavement 150 feet ahead and keep your eyes on this moving spot of light. Lighting engineers claim this technique overcomes temporary blindness caused by looking into undimmed headlights of an oncoming car, yet doesn't bother drivers in cars you meet.

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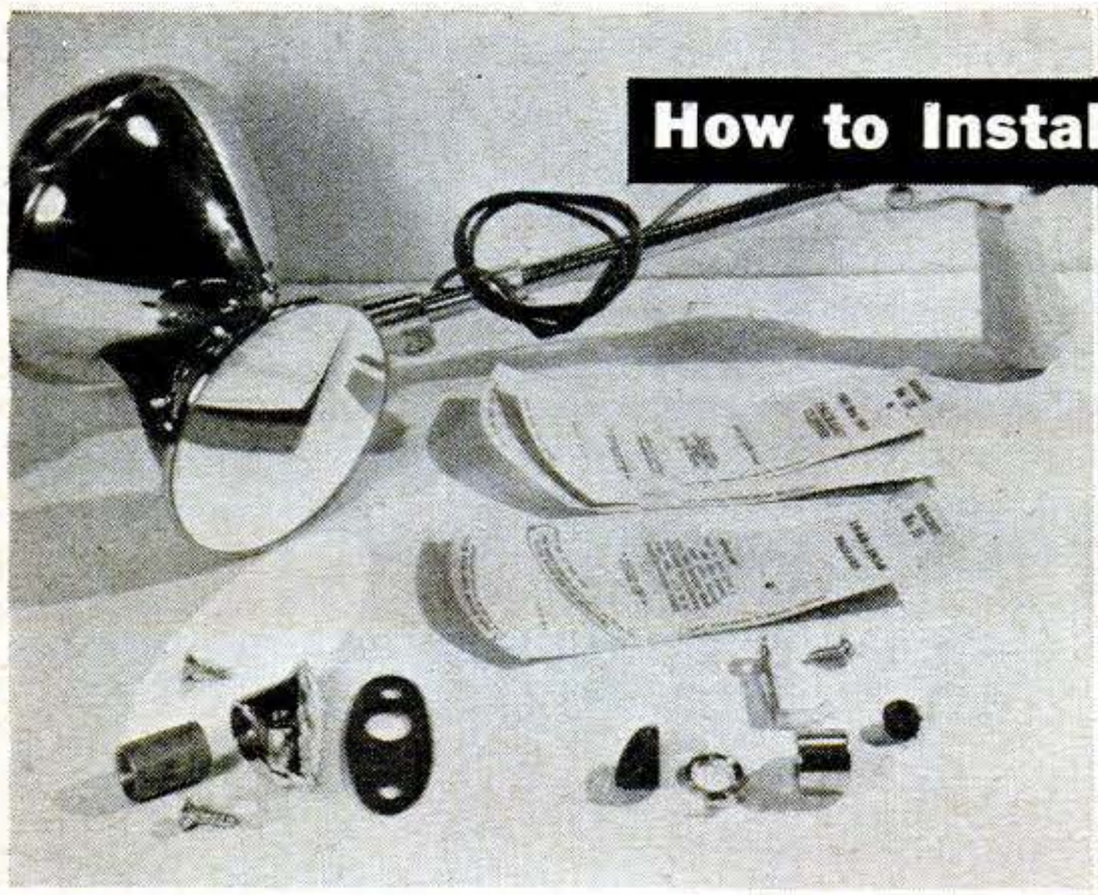
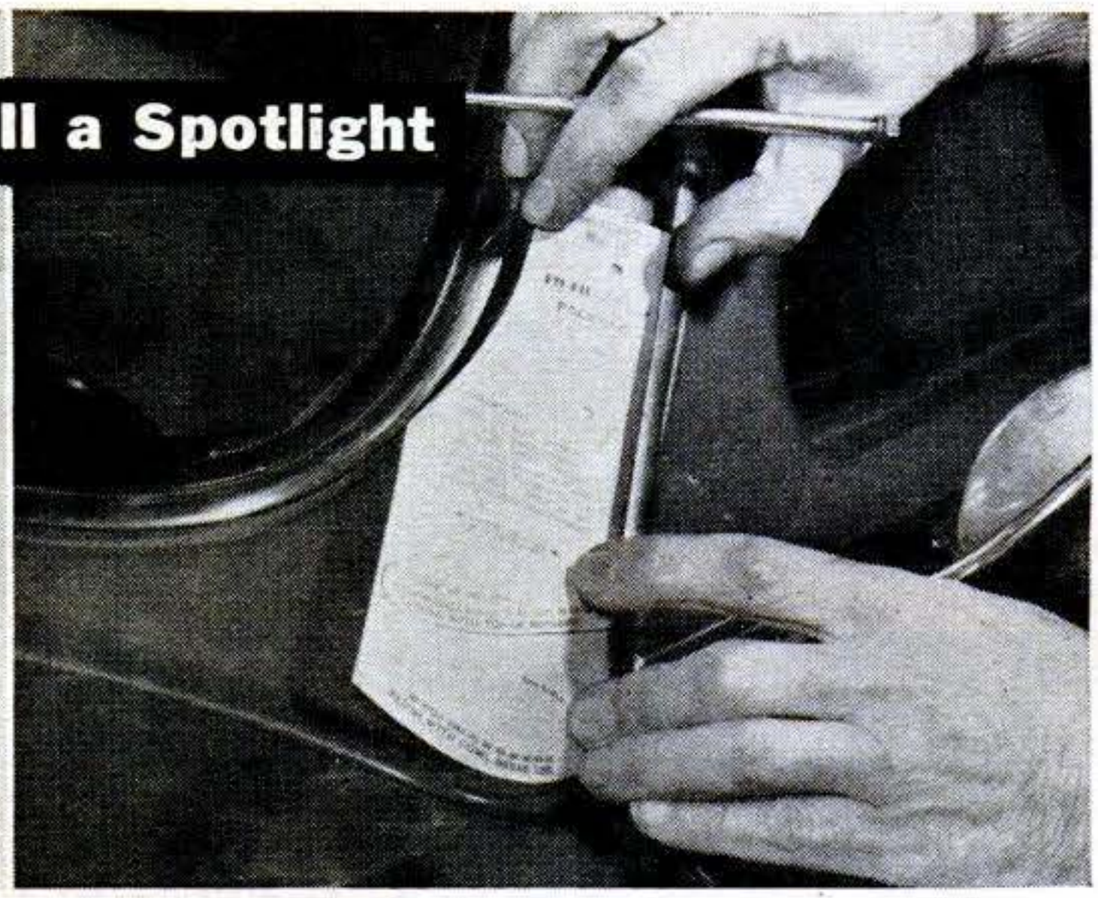
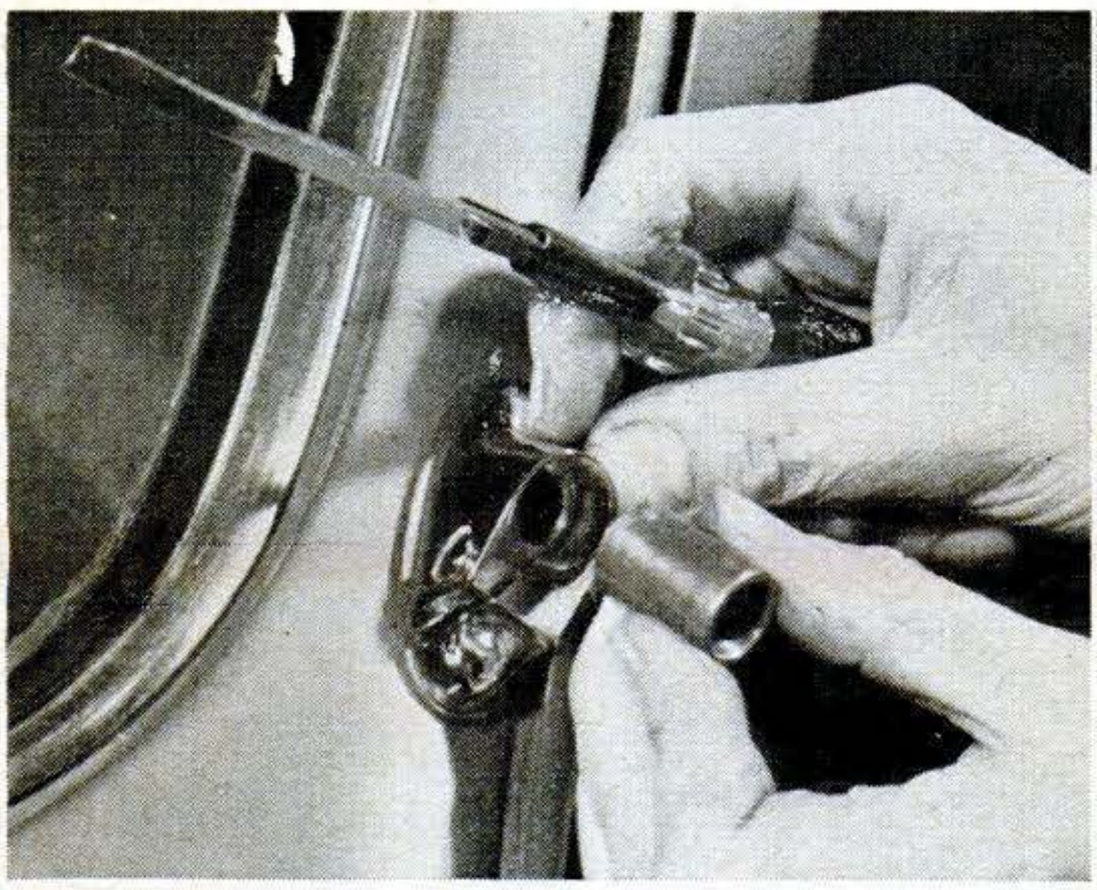
How to Install a Spotlight



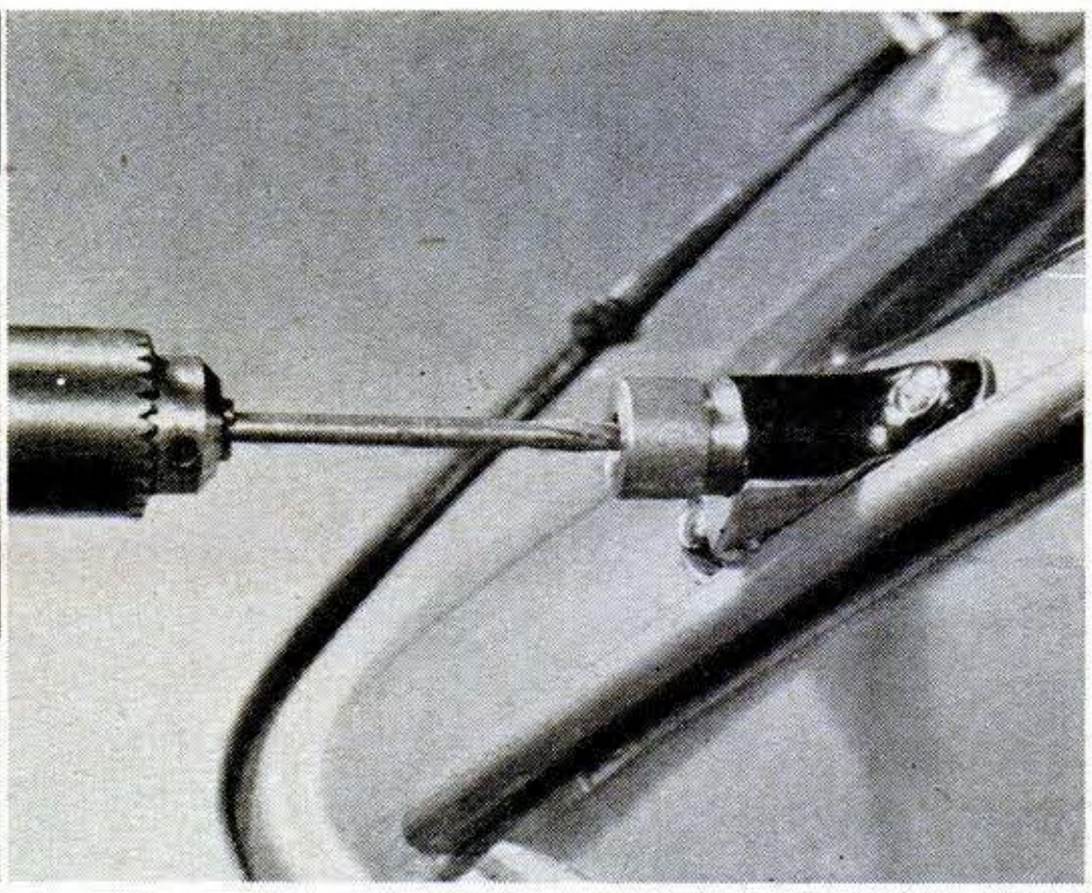
1. Typical spotlight kit, with inside control arm and adjustable mirror. In buying it, specify make, year, and model of car, and which side of the car you want it for—left or right.



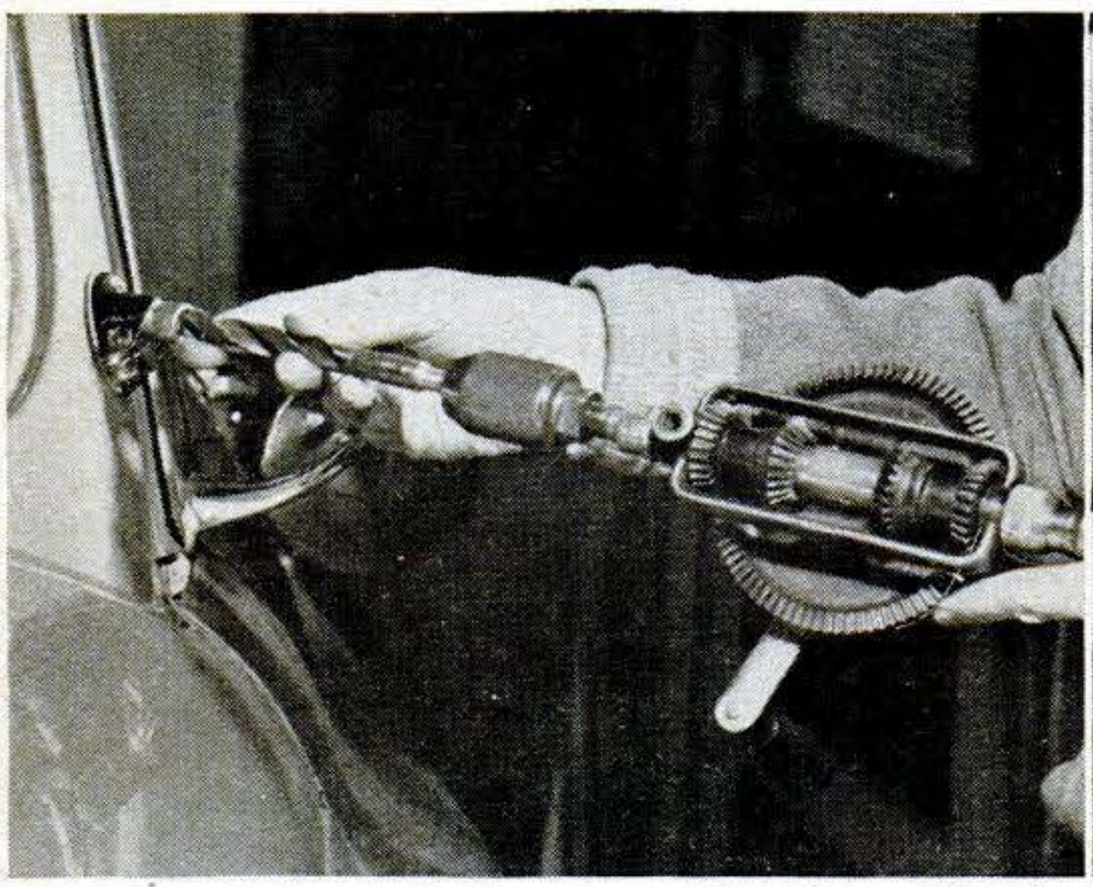
2. Template locates holes for self-tapping metal screws that hold outside mounting bracket to corner post. After drilling pilot holes, screw bracket in place with gasket under it.



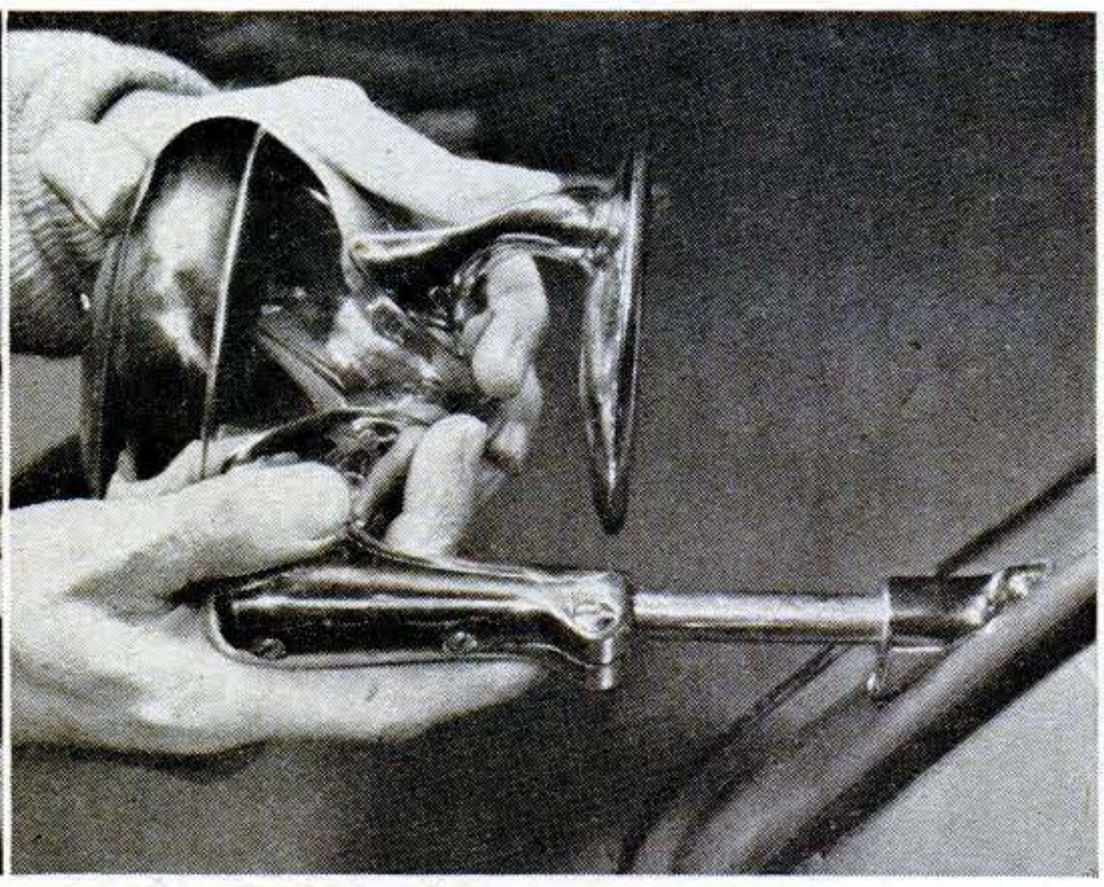
3. Bushing included in kit guides drilling of ½″ hole through post with a ½″ electric drill. If drill this size is not available, one way of making hole is shown in next two photos.



4. Machine a bushing for a 3/16″ bit, put into bracket, and drill through post. Then remove bracket and enlarge hole to almost ½″ by chucking a taper reamer in a hand brace.



5. Bring hole to final size with ½″ bit in hand drill. Guide bit by inserting ½″ bushing and securing with the setscrew in bracket. While drilling, push aside any wires inside post.



6. Install lamp by removing handle and shoving shaft through post, following manufacturer's directions. Wire lamp to a hot terminal, preferably through a 15- or 20-ampere fuse.

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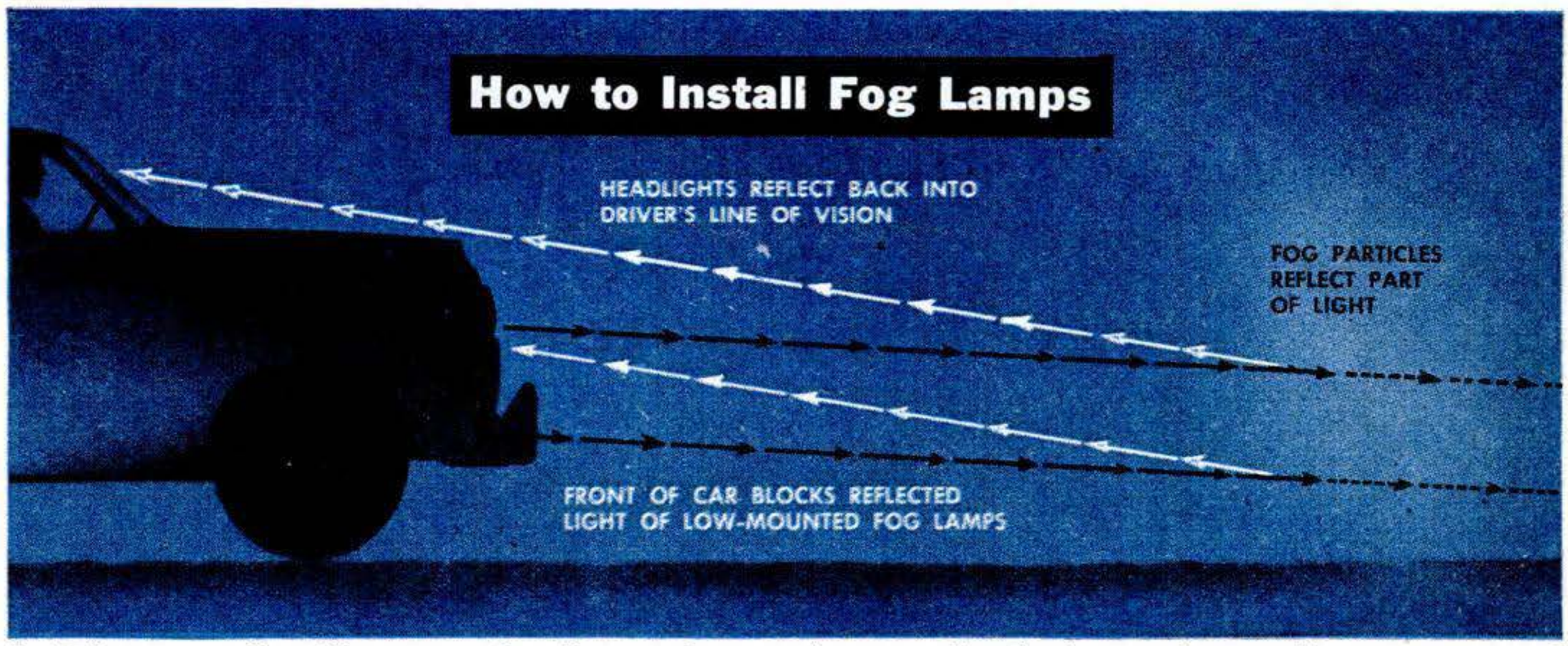
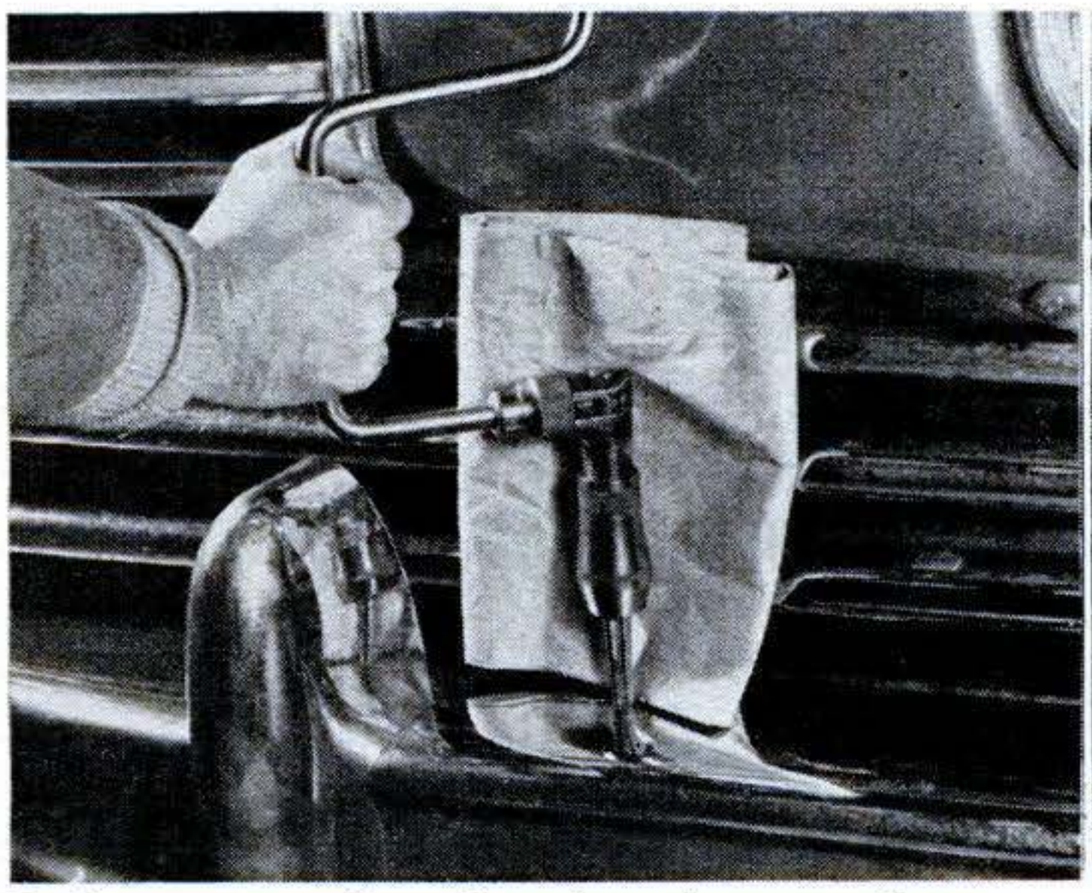
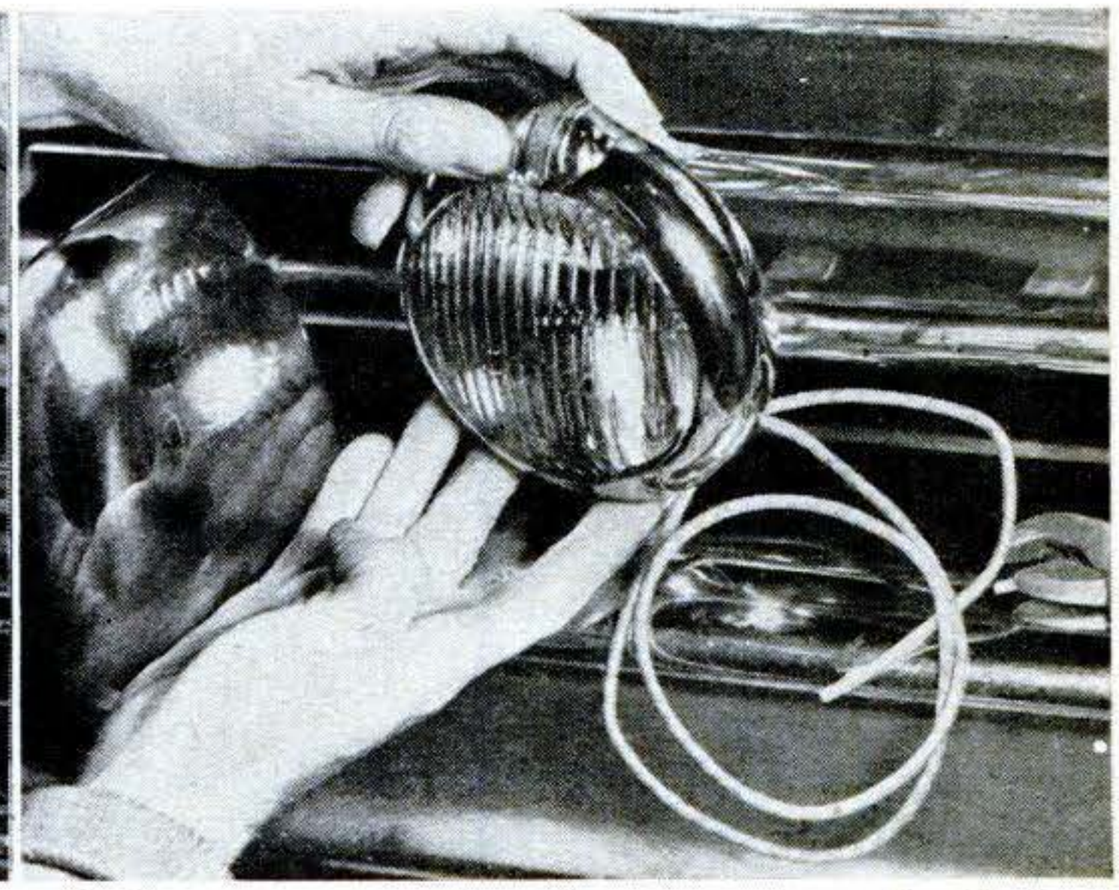
How to Install Fog Lamps



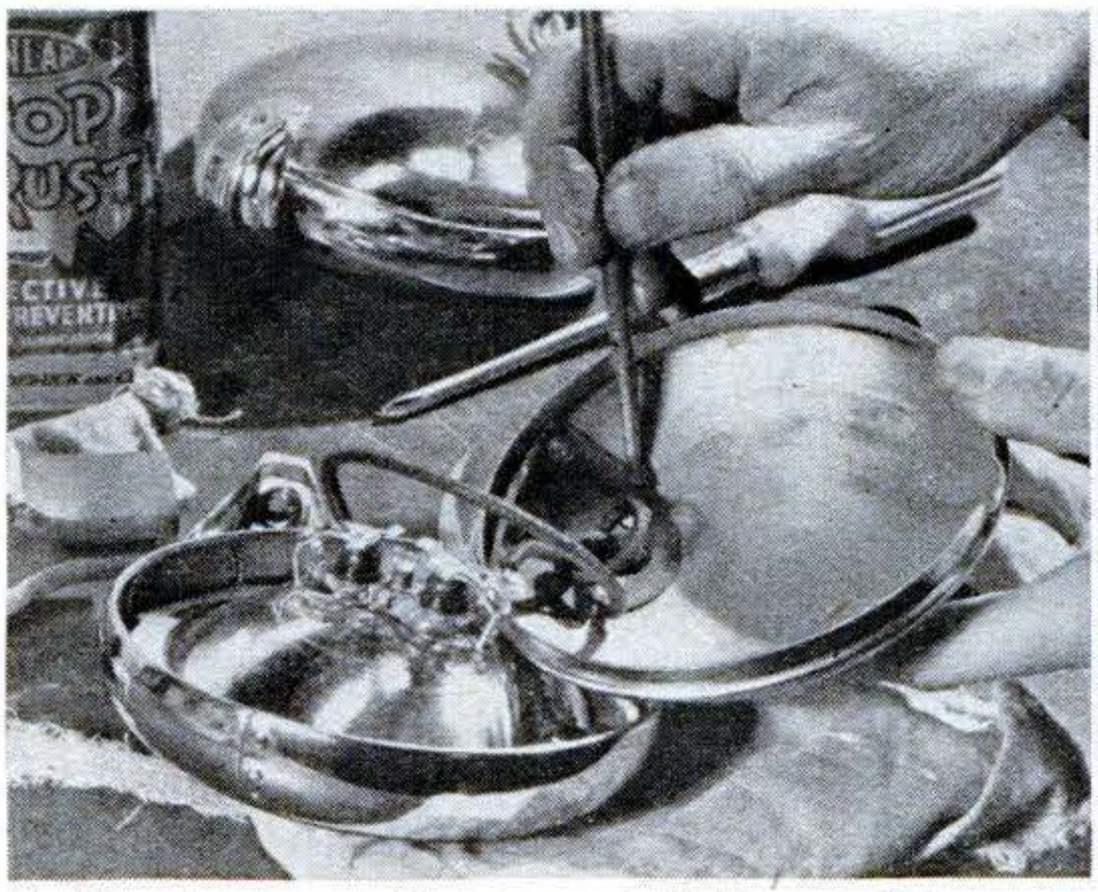
1. Why you should mount fog lamps low: Headlight beams are near your line of vision and thus tend to reflect light back to your eyes. Fog lamps overcome this. If they are placed at bumper level, front of car obscures most of the reflected light. For same reason, low beams of your headlamps are better for driving through fog than high beams.



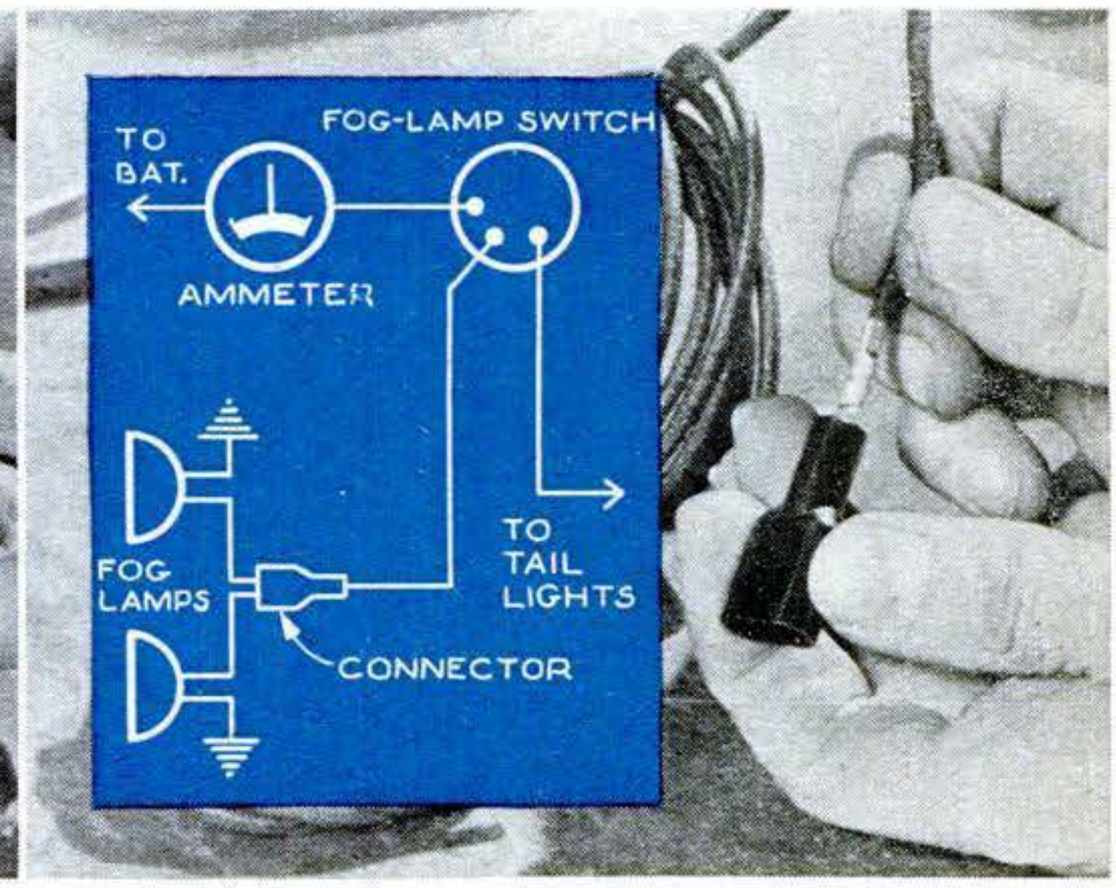
2. Lamps can be placed on bumper, bumper bracket, or gravel shield. In this case, bumper was drilled ¼", then reamed out as above for a ½" mounting bolt. The paper protects grille.



3. Lamp was aimed approximately before bracket was tightened. The beam should strike pavement about 75 feet ahead of the car. Lamp was placed near bumper guard to protect it.



4. Rusting can be retarded by applying a commercial preparation to the unplated surfaces of lamps. This is especially desirable near seashores and where salt is applied to winter roads.



5. Wire fog lamps so tail lights will operate with them. Typical fog-lamp switch has three terminals as diagramed. Connector in photo is useful for joining lamps' common leads.

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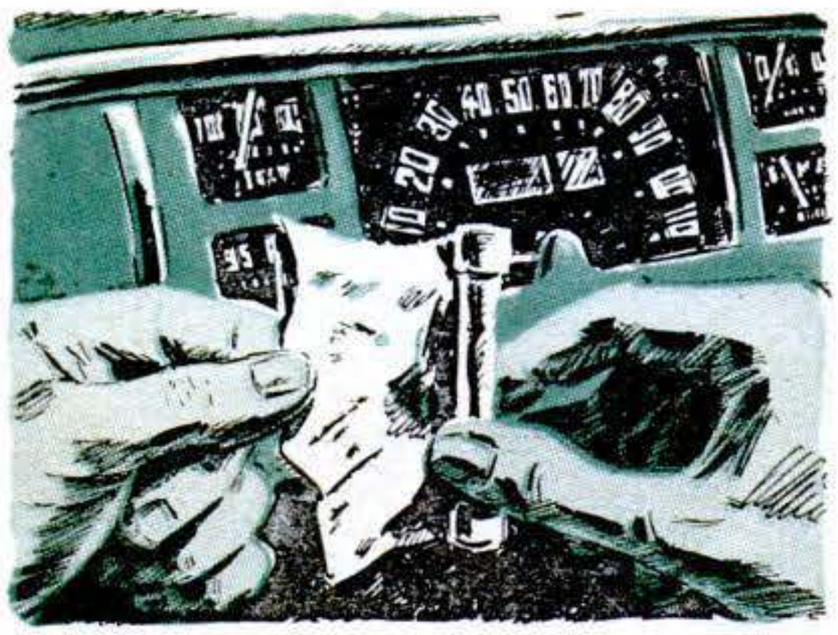
For Roadside Emergencies

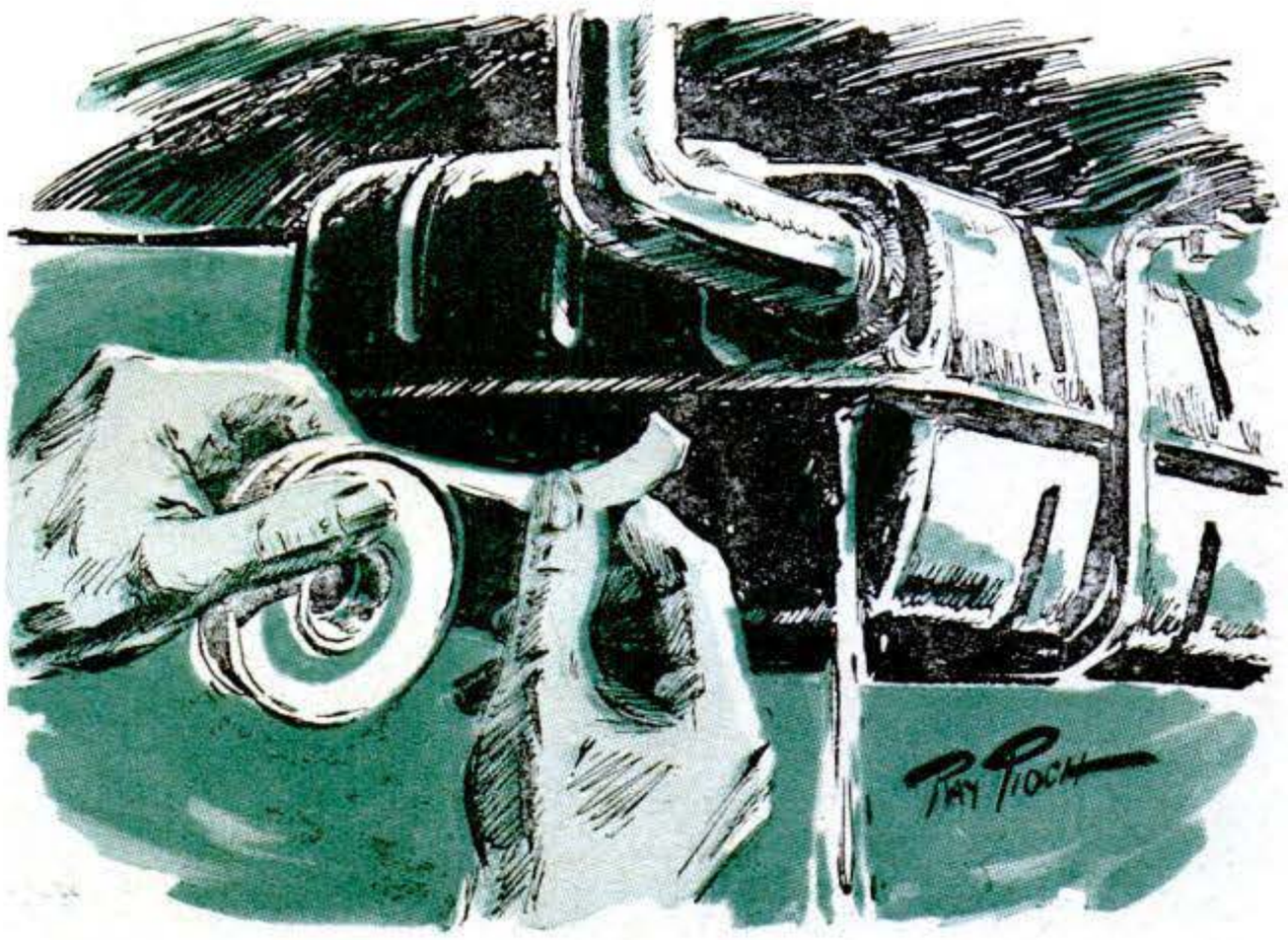
Caught without a jack, you can still change a tire on soft ground if you can find some bricks or flat rocks. Put a rock several inches thick in front of the wheel and ease the car up on it. Then put a close-fitting, square-based rock under the axle or jack pad. With a screwdriver or tire iron, dig the dirt away from under the first rock, remove it, and deepen the hole until you can change the wheel. Refill the hole and wedge rocks tightly under and ahead of the wheel, so you can climb a bit as you start to move forward. Then ease off the supporting rock.

You can carry water to your car in a big hub cap when no can or pail can be found.



When a fuse blows and you lack a spare, wrap the old one with foil from a cigarette package, and press it back into the clips. Caution: be sure to replace this makeshift at the next garage you come to.

Vapor lock can often be cured by pouring cold water or soda pop on the fuel pump and line. Driving with half a grapefruit or lemon on top of the pump is another trick. The evaporating juices cool the fuel, and the rind adds insulation.



A leaking gas tank might be patched temporarily with chewing gum or surgical tape. Dry off the metal first. If available, shellac over several layers of paper or cloth may also work. A boiler plug will tide you over until you can get a new tank. To make one, turn up a self-tapping screw and washer against a leather patch and apply shellac. Check the tank—one leak may mean others soon.

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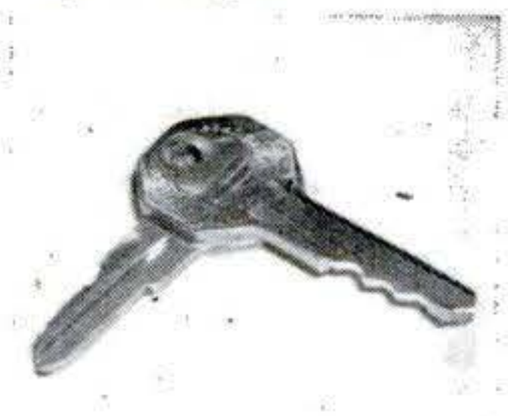
Lining Saves Exhaust Extension

To KEEP a tailpipe extension in good shape, take a sheet of aluminum or copper and beat it into a rough fit inside the stamped extension. Then clamp both on the tailpipe. If exhaust fumes eat out the inner one, replace it with another.—*Arne O. Salonen, Raymond, Wash.*

Open Cowl Vent to Keep Out Dust

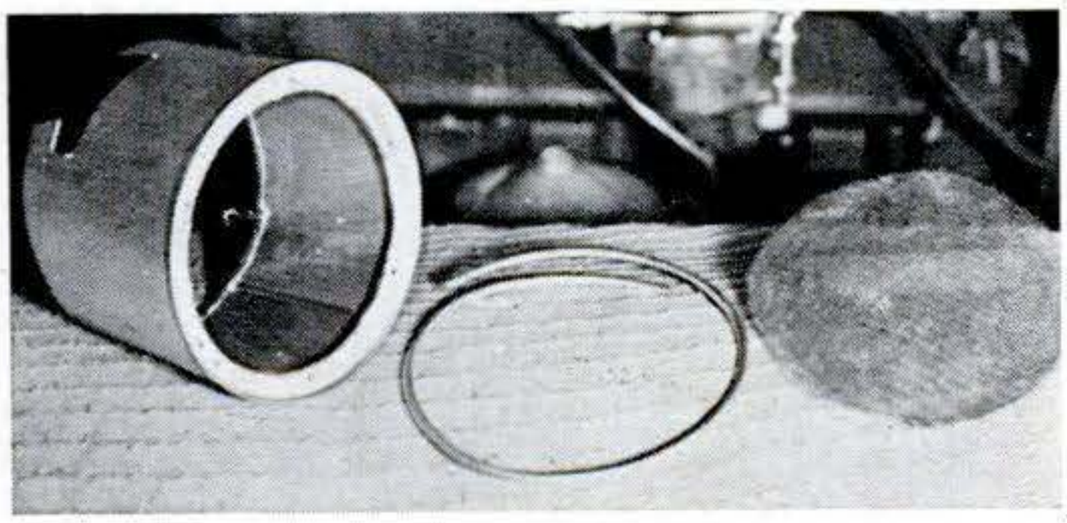
WHEN you drive on dusty roads, close the windows and open the cowl vent halfway. Air through the vent produces sufficient pressure inside to keep dust from coming in through the floor.—*Frederick Manter, Keesler Air Force Base, Miss.*

Soldered Keys Are Easy to Spot

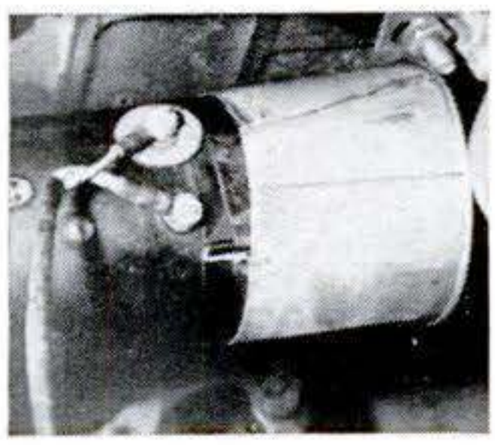


A CAR often calls for two different keys. Sweat-soldering them together like this has several advantages. When one is placed in the keyhole, the other serves as a convenient handle. Also, they are easily identified when carried on a ring or in a pocketful of change.—*Charles S. White, Vernon, Texas.*

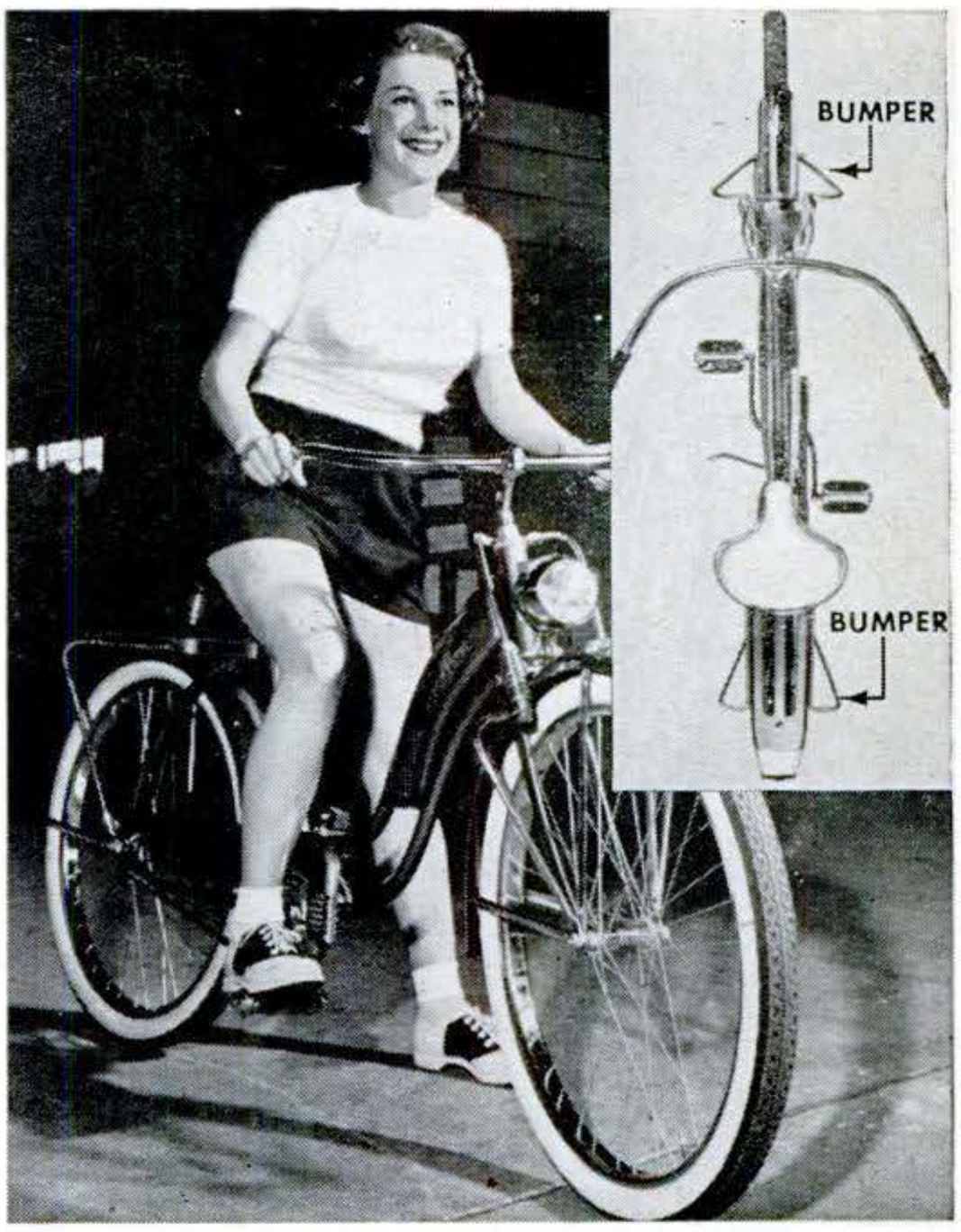
Air Screen Guards Generator



A GENERATOR located beside the engine may suck in sand or gravel through the cooling vents. This dirt can score the commutator. To protect the generator, fasten two disks of fine screening in a housing made from a tin can. Screen is mounted on the commutator end of the generator.



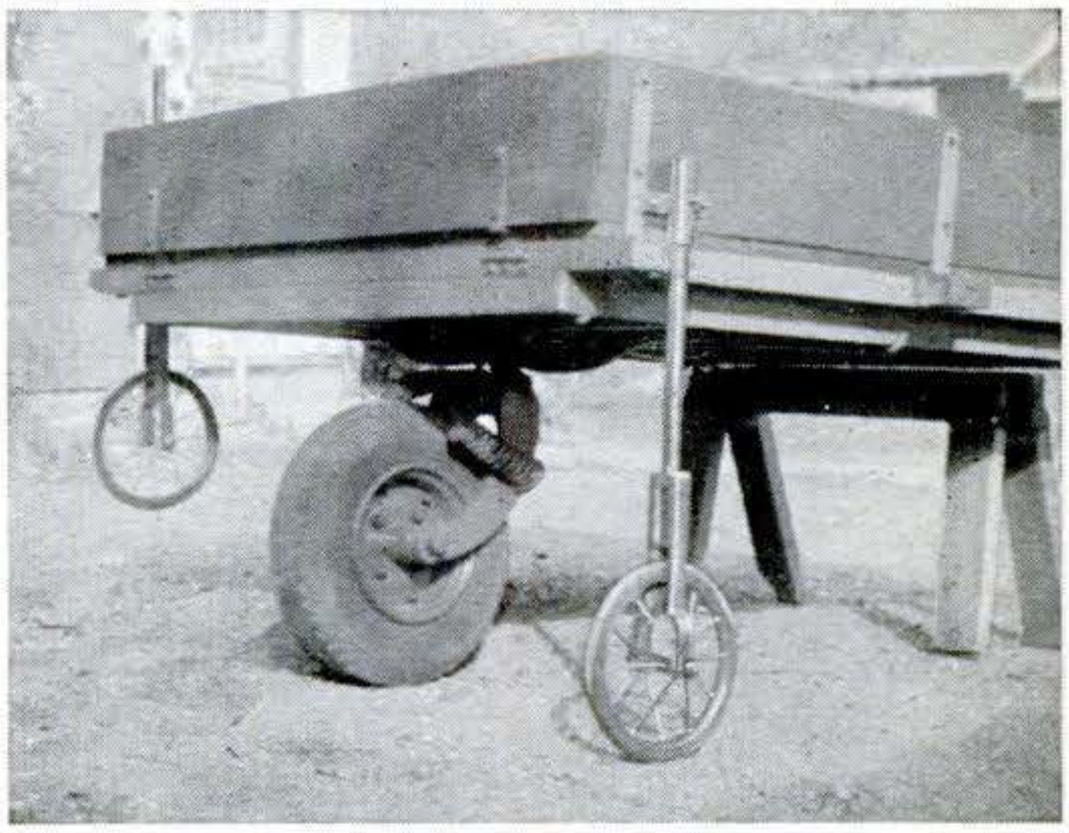
New Bicycle Has Side Bumpers



SIDE bumpers on the front and rear wheels keep this new Roadmaster bicycle from being marred or damaged if it falls. They also help protect the rider if the bicycle brushes a fence or wall. The Cleveland Welding Company makes the bike and bumpers.

Retractable Wheels Support Trailer

MY ONE-WHEEL trailer now stays upright when it's unhitched from the car. Retractable balance wheels, salvaged from a tricycle, do the trick. A fork for each wheel was made by welding flat pieces of iron on opposite sides of a pipe. The pipe slides up and down through a larger pipe clamped to the trailer body. Setscrews keep the pipe in any desired position.—*Carl M. Miller, Zion, Ill.*



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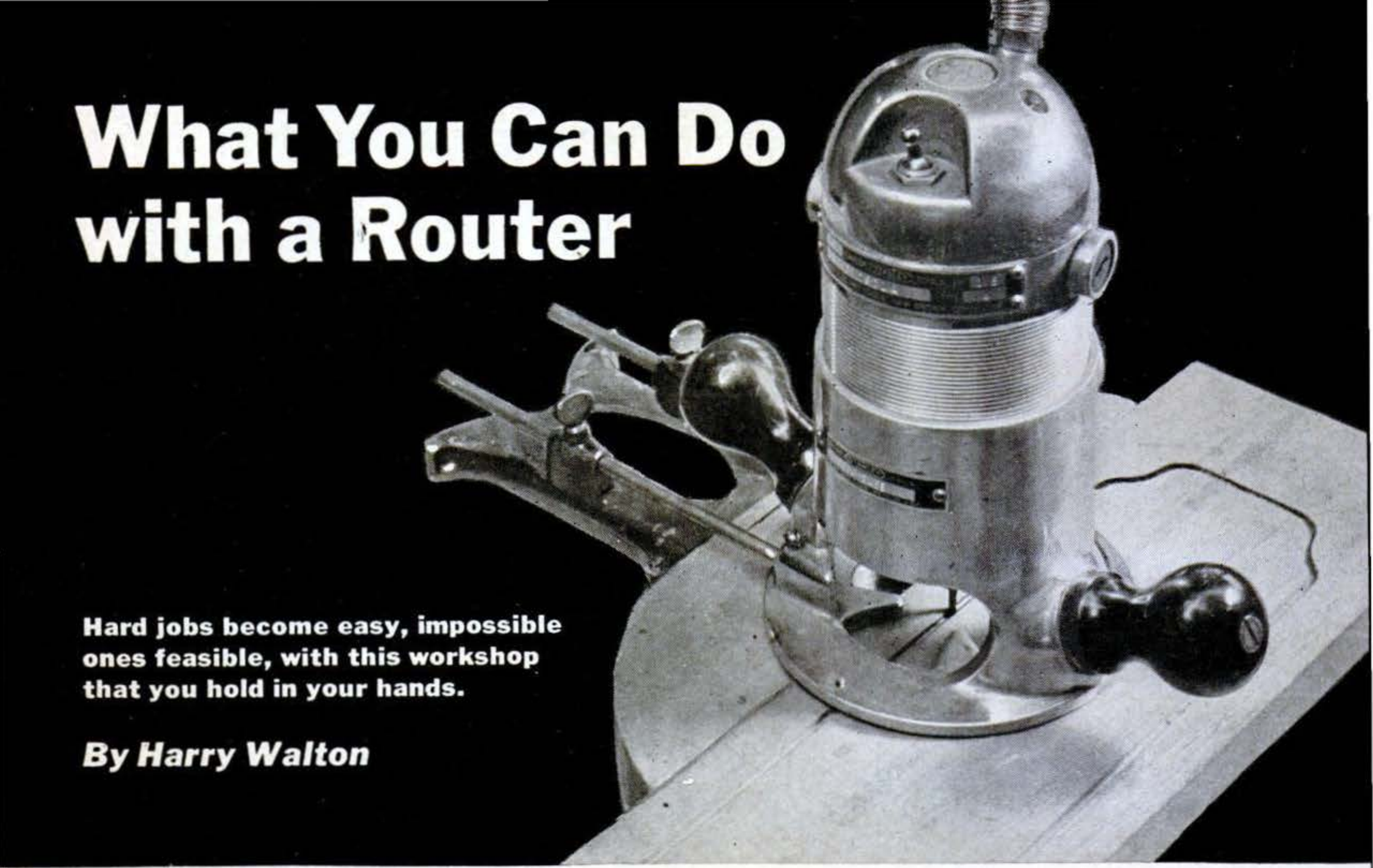
What You Can Do with a Router



Hard jobs become easy, impossible ones feasible, with this workshop that you hold in your hands.

By Harry Walton

"THERE," said Frazer, setting aside the chair he had repaired. "What's new?"

Jim Gilmore grinned. "Well, Jane and I have agreed to divide up that bonus. My share's enough to buy one of those routers you swear by."

"Fine. You'll find it takes up where other tools leave off. When'll you buy it?"

Gilmore's smile faded. "I haven't quite decided. Guess I came to look at yours and ask questions."

Stooping, Frazer took a gleaming little machine from a cabinet. "Here it is. Looks a bit like a vacuum cleaner, doesn't it? It *is* similar—a motor turning up to 18,000 r.p.m., with a threaded housing that screws into a base. Some others slip in, and are locked with a clamp screw."

"Is that the motor shaft underneath?"

"Yes. The cutters or bits are put into that hexagon chuck. Like this."

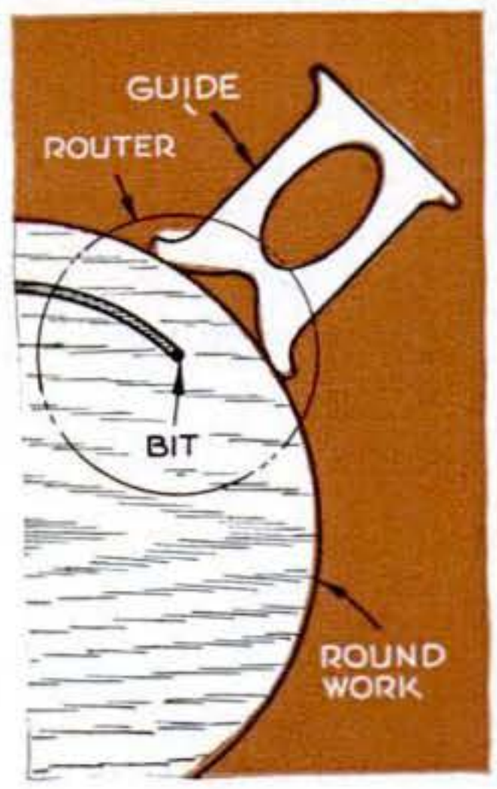
Frazer inserted a small round bit, tightened the hex nut, and plugged in the cord.

"By raising or lowering the motor in the base, you adjust the depth to which the bit cuts. I have it set ⅛″ deep."

He clamped a short board to his bench top, set the router on it, and started it.

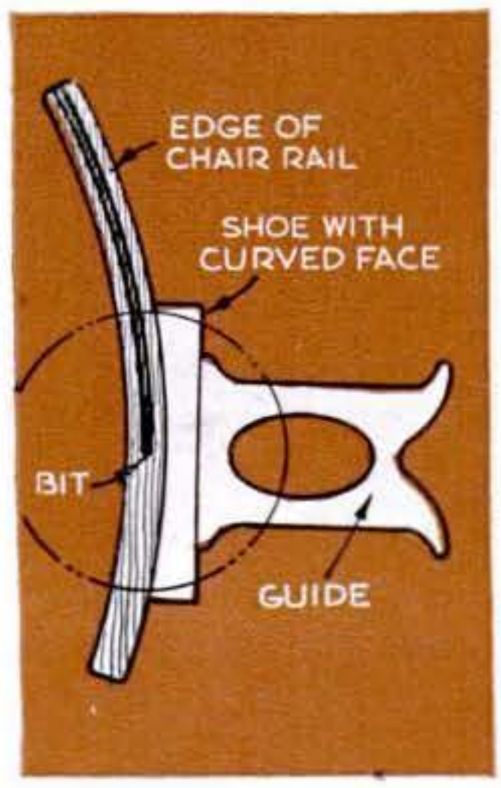
"You see," he shouted over its whine, "the base has openings through which you can look to steer the bit."

Slowly he guided the whirling bit over an irregular path. Then, shutting off the motor, he lifted it. Inscribed in the wood was the name "Jim."



"Handy for autographs," remarked Gilmore.

"Or for inlaying borders, or grooving edges. If you need a groove just inside the edge of a round table top, you clamp this guide on by two rods that fit bosses in the base. The Y-shaped end rides around the disk, and your groove is as true as the edge."



"Say, I have some curved chair rails I'd like to groove on the edges."

"That's easy. Cut a piece of wood to the same curvature, mount it on the straight side of the guide, and the groove will follow true right out to the ends."

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"Could I cut straight rabbets with it?"

"Of course. Wait till I change to a straight router bit. Then you try it."

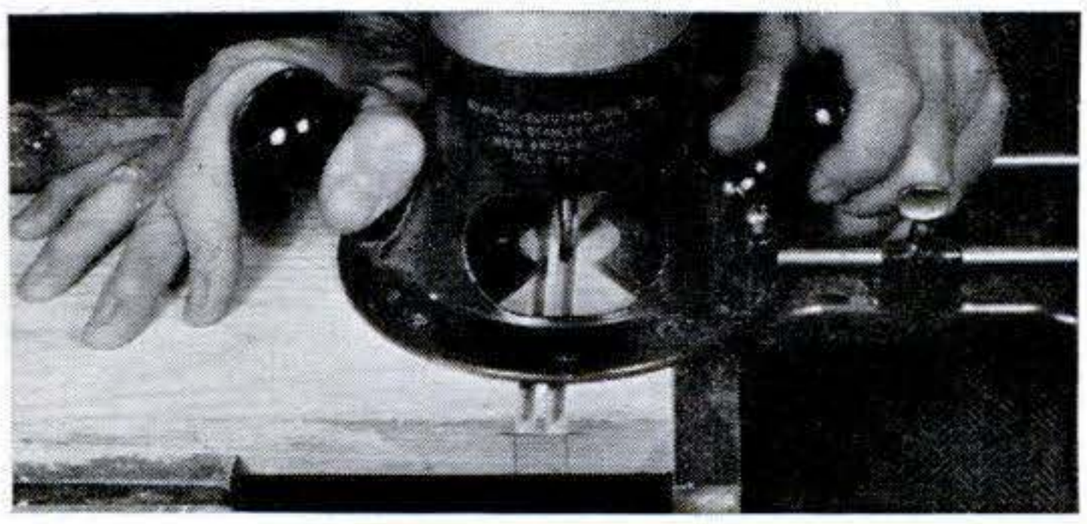
Gilmore started the tool and sailed along with growing confidence until the guide passed the end of the stock. Then the tool bit in sharply. He frantically switched off the motor.

"No harm done except to the rabbet," laughed Frazer. "To cut it true to the end, you'd screw a wooden fence to the guide—it has holes for screws. That would guide the tool until the bit is past the end of the stock."

"I get it," muttered Gilmore. "But suppose I want a rabbet wider than the bit?"

"You set the guide at the full width, and make freehand passes until the guide touches the edge. Your final pass gives you a perfect rabbet. You can even rabbet big work, like full sheets of plywood."

"That could come in handy. Say,



Straight side of guide is turned toward the cutter for dadoing a few inches from an edge.

wouldn't this bit make dadoes, too?"

"Sure it will. With the guide, you can dado a few inches back from an edge. Farther away, you'd use a template."

"Now it's getting complicated."

Frazer laughed. "Oh, no. You do have to cut a template out of thin sheet stuff, but you do it with the router, in no time. I need one myself. Want to watch?"

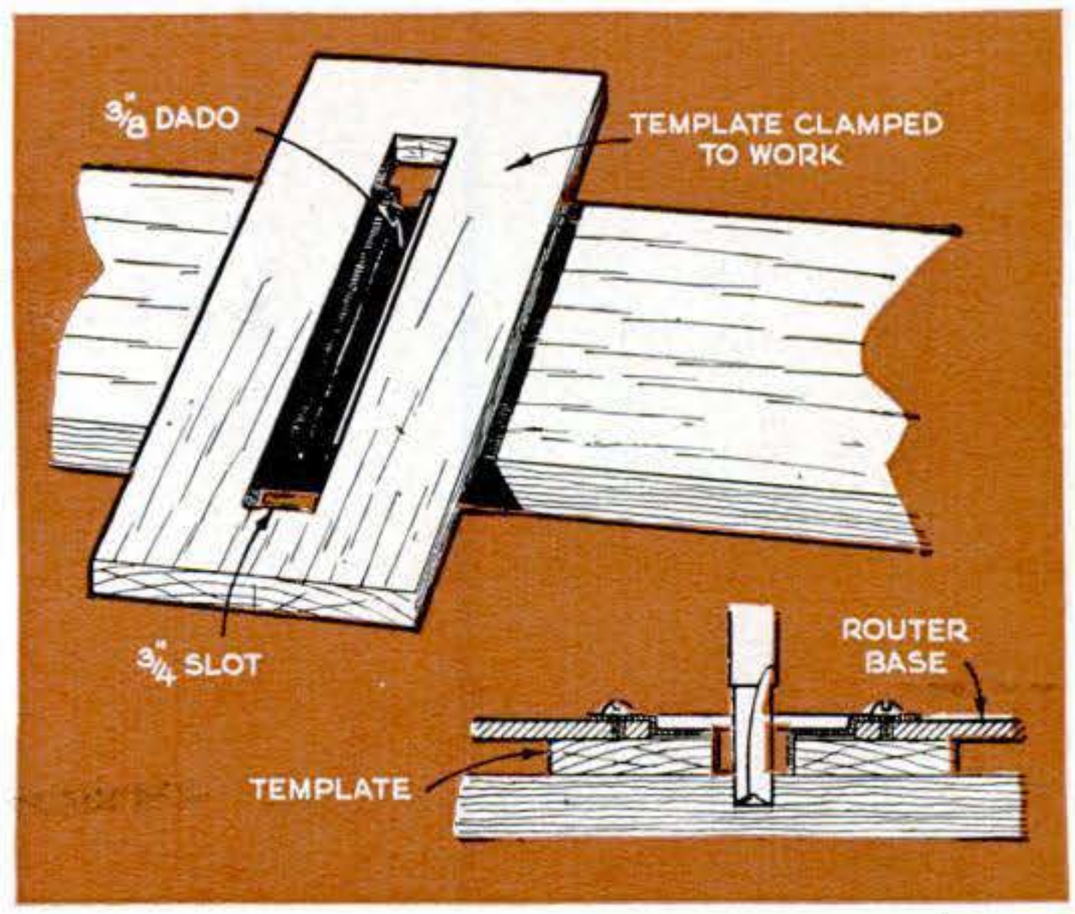
Clamping a 6″ by 12″ piece of plywood so that it overhung the bench, Frazer set the guide about 3″ from the bit and quickly cut a blind slot in the wood. Then he reset the guide with a rule, routed one end of the slot wider, and stopped to try the flange of a washer-like object in the opening.

"What's that?" asked Gilmore.

"It's called a bit guide. The flange diameter is ¾″. For a dado the size of the bit, I want a slot just flange size."

"I don't get it," said Gilmore.

"You will, pretty quick." Frazer finished widening the slot. Removing the motor, he



attached the bit guide to the base with two screws. "You see, the router bit goes through the hole in the guide. I'll clamp the template across the work. The flange of the bit guide will ride in the slot, guiding the bit down the middle to cut a ⅜″ dado. For a ⅝″ dado, I'd cut the slot 1″ wide."

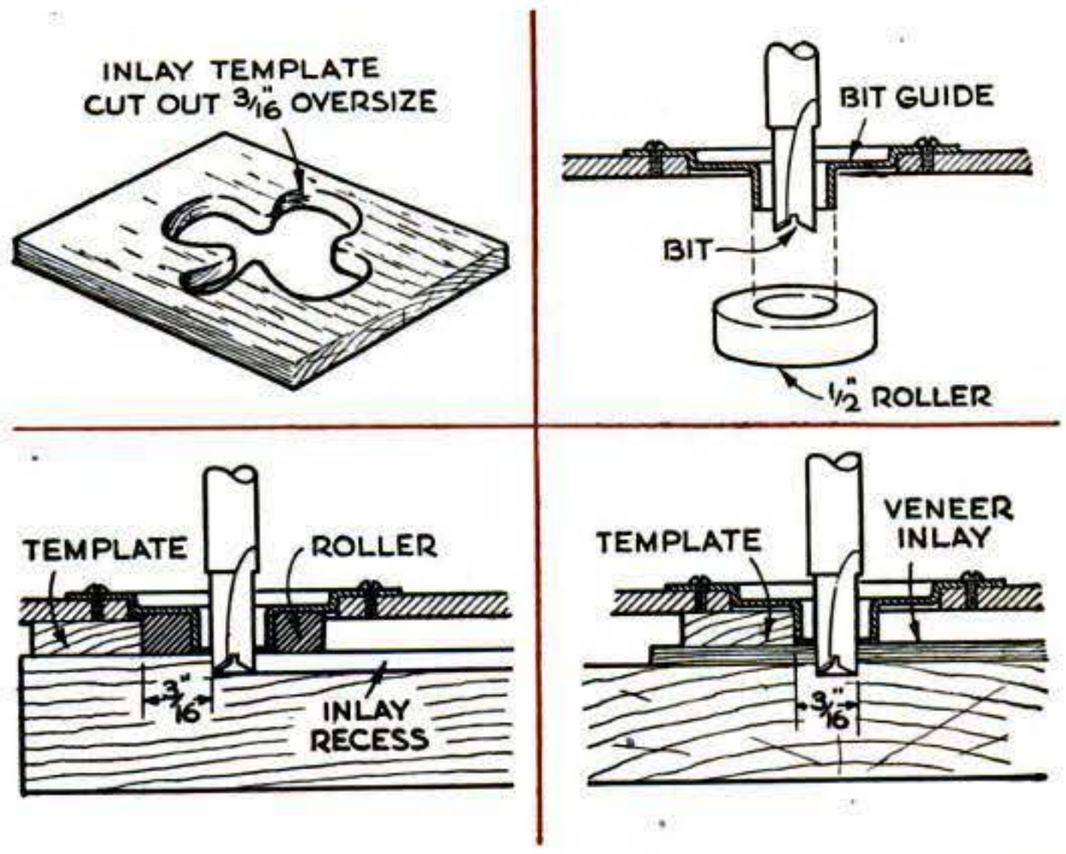
"That's neat. You could use that dodge to cut shallow recesses or mortises, too."

"Yes, but the neatest template trick is making perfect inlays. First you cut an inside template the shape of the inlay, but 3/16″ bigger all around. Then you mount a bit guide, but over the flange you slip a ½″ collar. You clamp the template on the work, and with the collar rolling against the inside edge, rout out the inlay recess.

"Then you take off the collar, and with the same template, rout the inlay itself to shape. It's bound to be a perfect fit."

"I'd need a diagram to get that!"

"Okay, look." Frazer sketched rapidly. "Remember, the template opening is 3/16″ oversize. That's also the distance from the bit to the guiding edge of the collar. And when you rout the inlay, it's just 3/16″



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from the guide flange to the other side of the cutter."

Gilmore straightened up. "Now I see it. Why, I need a router just for inlay work."

"Maybe," laughed Frazer. "But it will also do reeding, fluting, beading, and carving. You could turn out fretsaw work, in quantity, faster than with a jigsaw. Buy a special attachment, and you have a power plane. Do you ever do dovetailing?"

"Seldom. It's just too much work."

"Not with this." Frazer drew an odd-looking gadget from a cabinet. "This is a finger template. You clamp both parts of the joint in it, mount a guide tip and a dovetail bit in your router, and run in and out of the fingers on this comb. You cut both members of either blind or open dovetails at once. I've done four box joints in six minutes."

Gilmore examined the device. "With this, I wouldn't mind making dovetails."

"You can borrow it when you like. Neither of us will cut dovetails every day. Say, weren't you thinking about a shaper?"

"Yes, but I haven't shop space for it."

"Well, your router is a shaper as well," said Frazer. "Want to see how?"

Gilmore nodded, and watched with interest as Frazer laid some bits on the bench.

"Here's one type of shaping cutter. The sharp-edged wings do the shaping, while the little stem at the end—called the pilot—bears against the unmolded part of the edge to guide the cut."

"I could use that," said Gilmore, "for drop-leaf joints on a table I'm building."

Frazer nodded. "You'd need a rounding-over bit and a cove bit. You can also get chamfering, beading, and ogee bits. And you can do shaping on an assembled frame."

Gilmore digested this slowly. "I wonder," he said, "if you'd let me try that on a small door I'm making?"

"Sure. The evening's young. Go get it."

While Gilmore was gone, Frazer cleared the workbench, upon which his friend presently laid a door frame.

"This is for a kitchen cabinet," Gilmore explained. "Junior swung on the old one, and it's falling apart. I built this with mortise-and-tenon joints, and was going to put a plywood panel on the outside. But it won't match the other door, and I'm afraid Jane won't like it."

"What's the molding on the other door like?" asked Frazer.

Gilmore held up a reddish lump. "I pushed some of Junior's modeling clay against it and got an impression in reverse."

"Fine," said Frazer. He compared the clay imprint with several bits. "This beading bit looks like it. Let's try it."

After several trial cuts on scrap, Frazer handed his friend the machine.

"All set to go. Remember to make the pass against the cutter rotation. Don't stop anywhere, or the pilot will burn the edge. At the corners, turn and keep going."

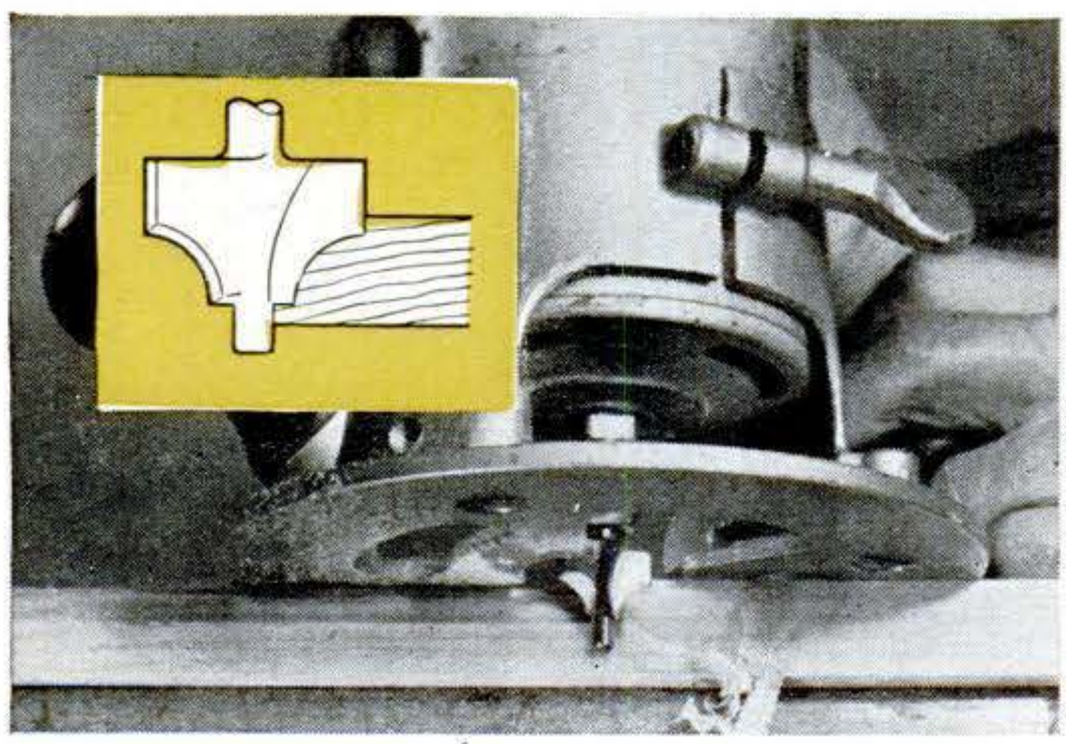
After a few minutes, Gilmore shut off the motor and proudly examined the frame.

"Jane will like this. And it was easy—much easier than molding the stock and mitering the joints to match at the corners."

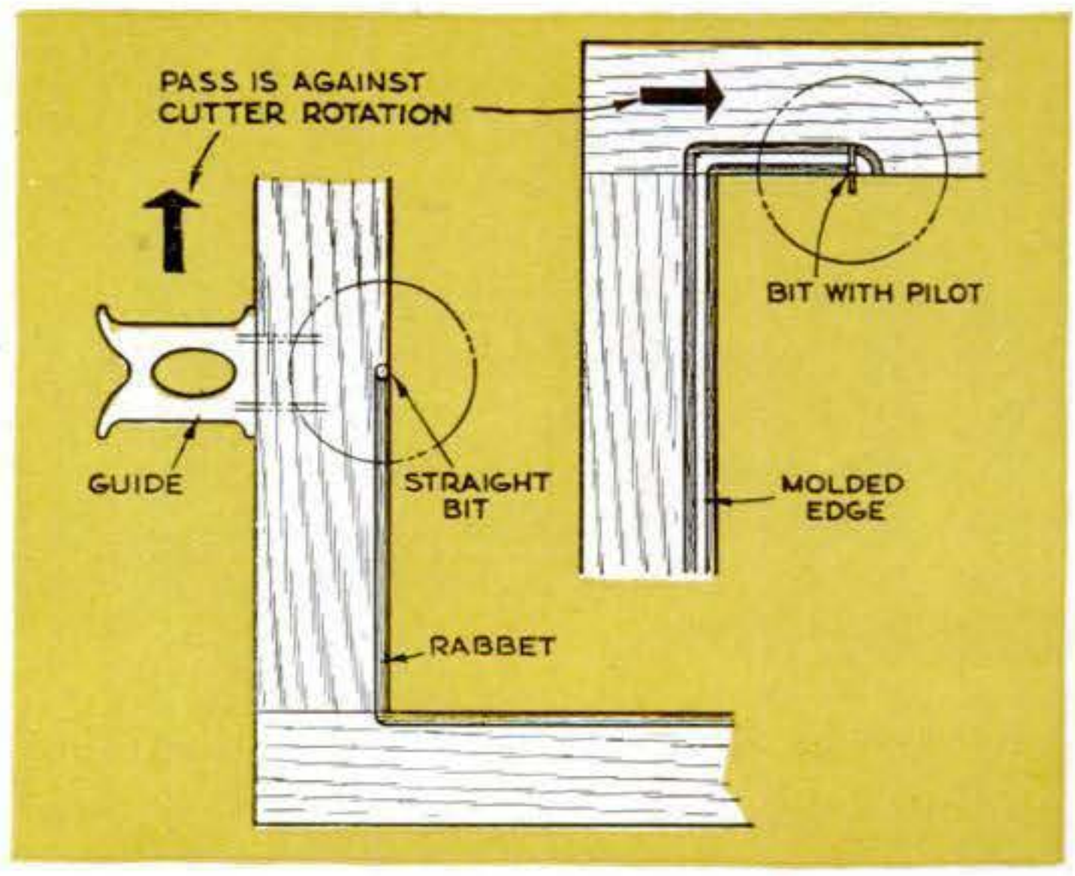
"Saves time, too," said Frazer. "The only difference is that your corners have a small radius instead of an angle."

"But say, I'll have to put the plywood panel behind the frame now, won't I?"

"Why, no. You can rout a rabbet for it, like the other door has. Use this straight bit and the guide, with its straight side toward the bit. But set the guide against the outside of the frame. That way you can



Pilot on this beading tip rides the uncut part of the edge. The pass above is made to the right.



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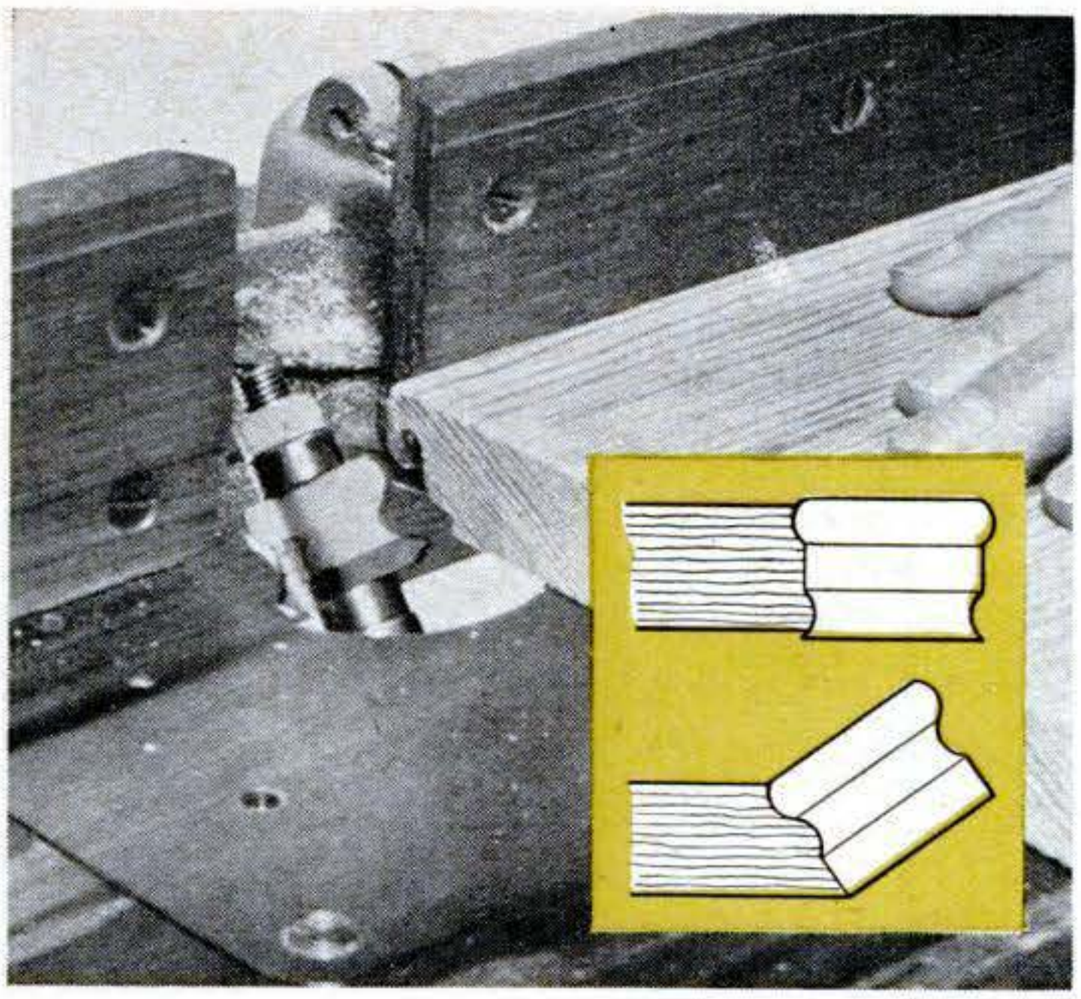
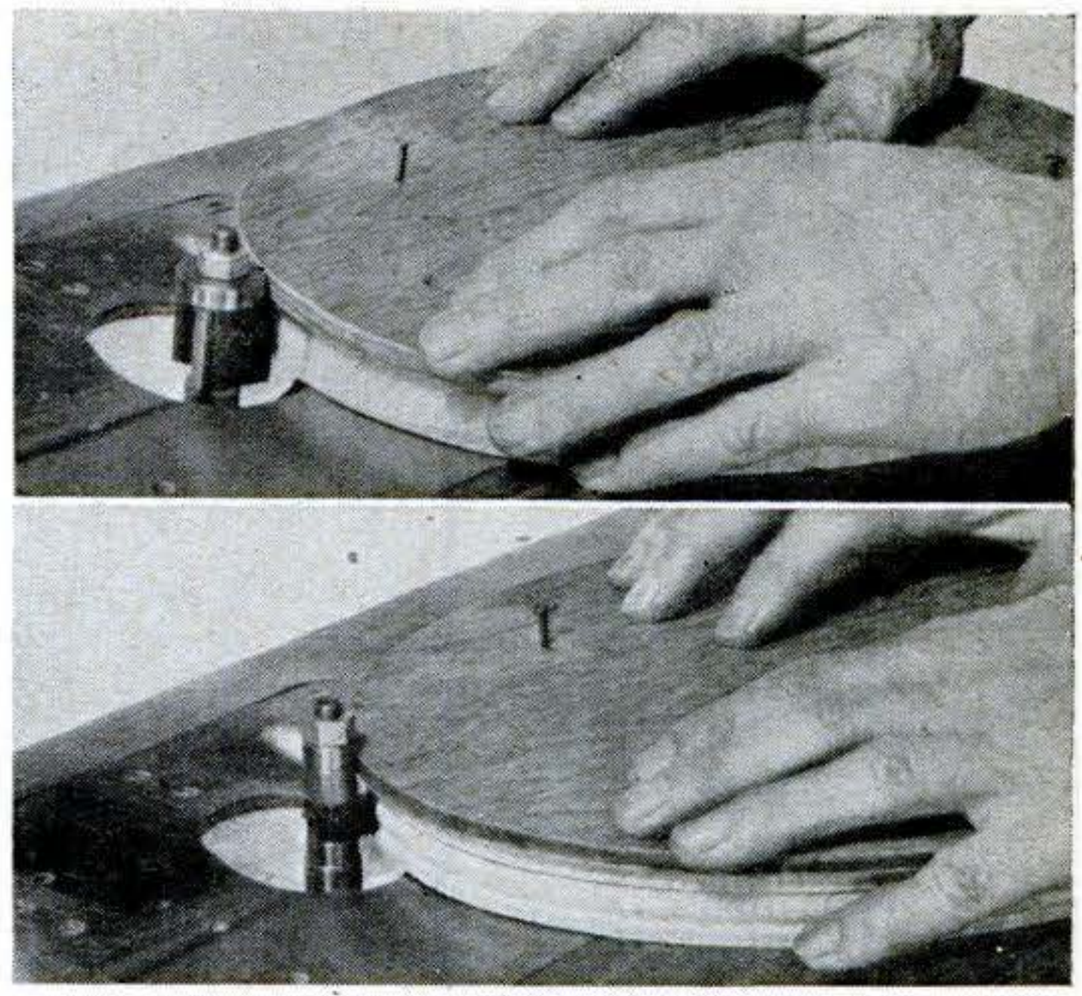


One way to mount three typical cutters on the arbor, and how they shape different moldings when the arbor is tilted, are shown above. Fence guides work, passed from right to left.



Plywood template rides against collar as a straight cutter trues entire edge to shape (top photo). Same template is being used in lower photo to shape a molding on the edge.

rabbet right into the corners. Of course, you'll lift the router to get around them."

"Thanks a lot. That should make a good match. Say, couldn't you mount the motor upside down on a table and run molding against it?"

"Of course. You can rig your own, or buy a mounting plate that holds the motor under a bench or table top. The shaft projects above. A special arbor holds small shaper cutters, which are clamped with a nut.

"Straight work can be guided against a fence, but when only part of an edge is to be shaped, you can mount a collar on the arbor alongside the cutter. The unshaped part touches the collar, limiting the depth of cut."

"You mean a fence isn't needed?"

"No, you work freehand. It's good to brace the work against a starting stud, also called a circular guide, as you swing it into the cutter. Of course you need a clean, true edge, because the collar follows it exactly and reproduces irregularities."

"I see that. But suppose the edge isn't true, or you want to mold clean across it, leaving nothing for the collar to ride on?"

"You can do that with a template. Cut it carefully to shape, saw the workpiece oversize, and tack the template to it. Set up the collar at a height where it will ride the edge of the template."

"Pretty neat. I suppose the more cutters you have, the better."

"No, you can do a variety of work with just a few. The shaper mount has means for tilting the motor. At different angles, the same cutters shape different moldings."

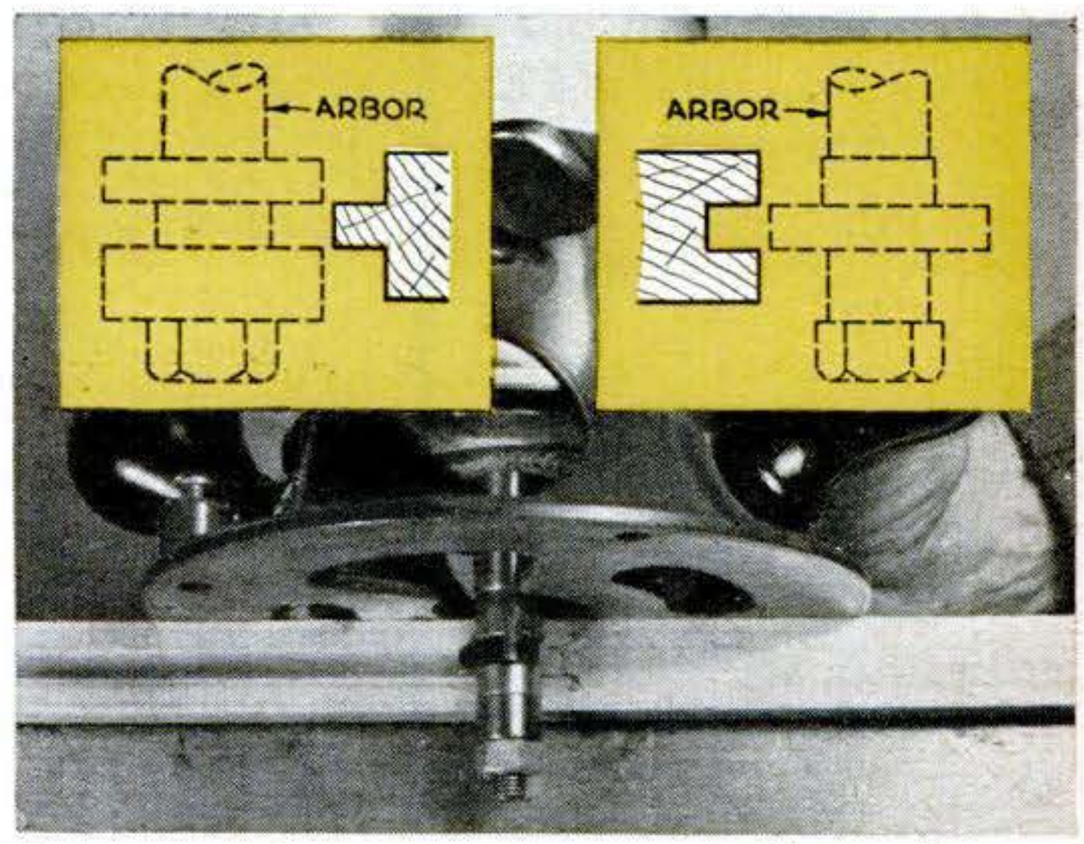
"I had no idea the router would do so much," confessed Gilmore. "Thanks for all the dope."

"That's all right. It's a pleasure to show what a good tool can do, and you'll probably be showing me some new uses for it. Anything else you want to see it do?"

"Sure, said Gilmore." I want to rabbet that frame for the panel."

"Of course. That won't take long."

"Then I'm going to take it home and fit it. Because if Jane should want to change her mind about splitting that bonus. . . ." Then he grinned, "With that swank cabinet door, I'm sure I could change it back." END



Tongue-and-groove joint is made with two cutters, one the same width as the collar. After tongue is cut (left above) collar and one cutter are switched to make the groove.

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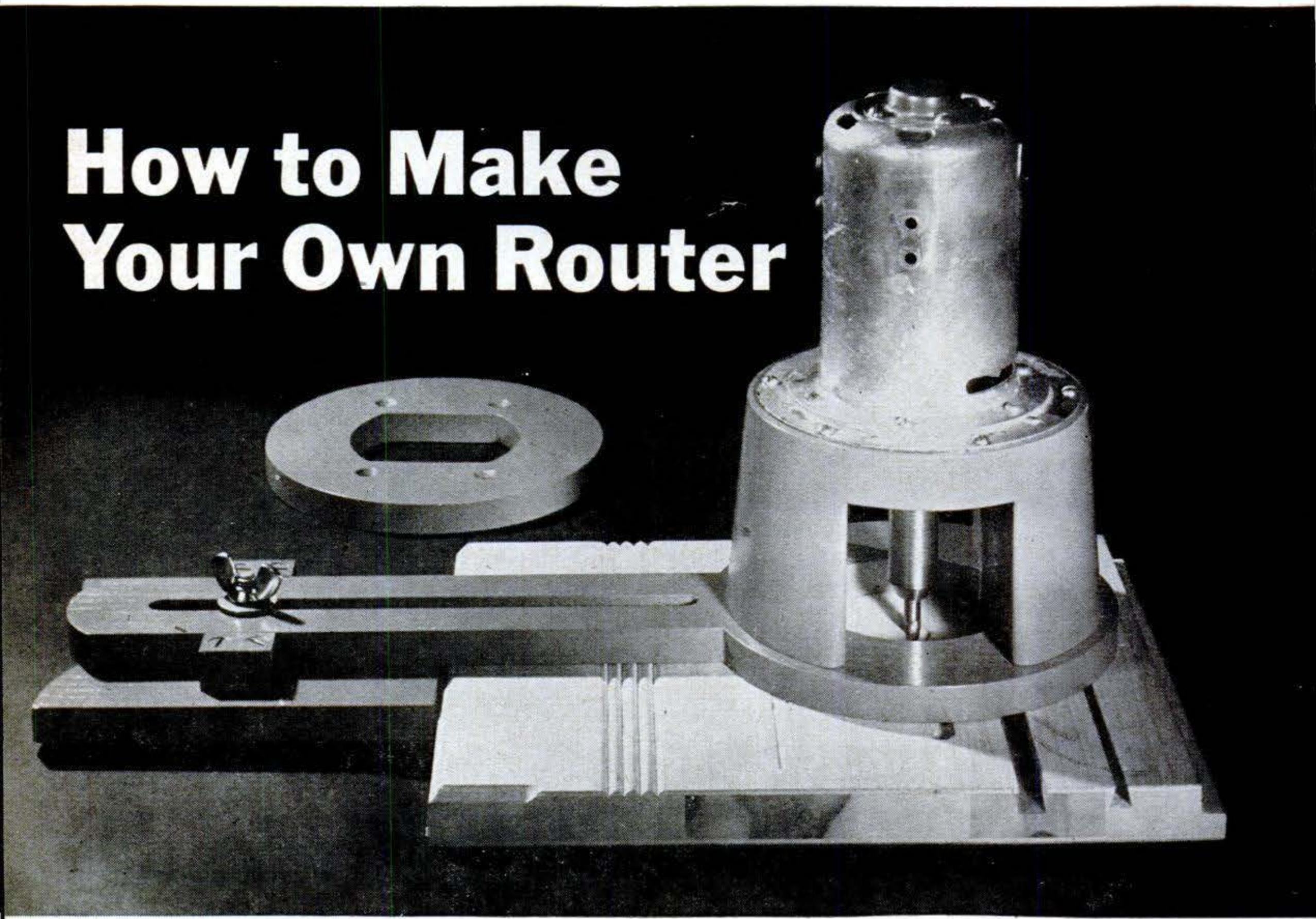
How to Make Your Own Router



Driven by a vacuum-cleaner motor, this rugged little machine handles easily and makes a variety of clean cuts.

By Herbert Pfister

IF A vacuum-cleaner motor could think, I imagine it would get a terrific bang out of switching overnight from the hind end of a dust-sucking machine to top spot on a high-speed router strewing dust and chips in its wake.

That's what happened to the motor I had saved from a vacuum cleaner we had replaced. Vac motors have plenty of speed and guts, and can make rugged, dependable routers. Mine never overheats or slows down even on the tough cuts.

The router body that I built to use with this motor has two interchangeable soles—a slotted, key-shaped one for use with the guide that rides on an edge, and a round one for freehand routing or shaping with pilot bits.

Overhaul the motor. You too, may have a cleaner you can salvage a motor from. If not, you can buy a used motor reasonably. Clean the commutator and if necessary replace the brushes. Also check the rotation. For use in a router, the shaft must turn clockwise as you look down on it on the work.

If it turns counterclockwise, switching the wires that lead to the brush holders will reverse the direction. Cut off or unsolder the connections. If necessary, add insulated wire to each lead to reach the opposite side of the motor. Solder the new leads to the brush holders.

Installing a switch. A thumb-controlled toggle will get you by, but an on-and-off pedal will be more convenient. The best arrangement is a foot rheostat such as you find on sewing machines. Never let the motor run at full voltage without load.

Machining a chuck. You need something to hold the variety of cutters available and a means of adjusting the depth of cut. The sleeve and spindle arrangement shown is simple and efficient. It permits depth adjustments from zero to ¾". This should take care of 98 percent of all jobs.

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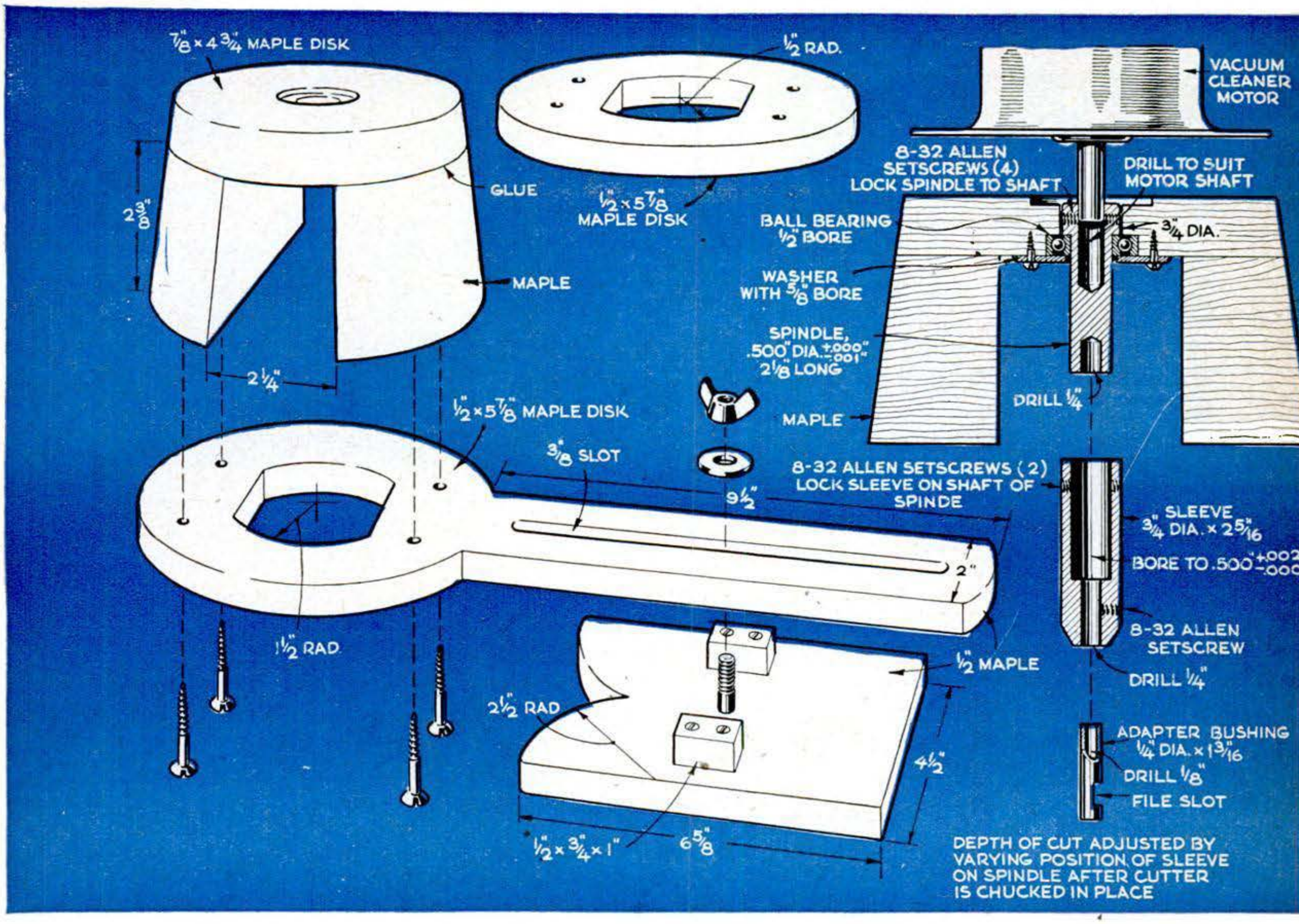


All machining dimensions are given on the drawing except the diameter of the hole into which the motor shaft slips. The shaft of my motor is 5/16", but yours may differ. A local machine shop should be willing to make up the parts at low cost. The chuck sleeve should fit over the spindle with no more than .002" tolerance. A sloppy fit will cause chatter and vibration.

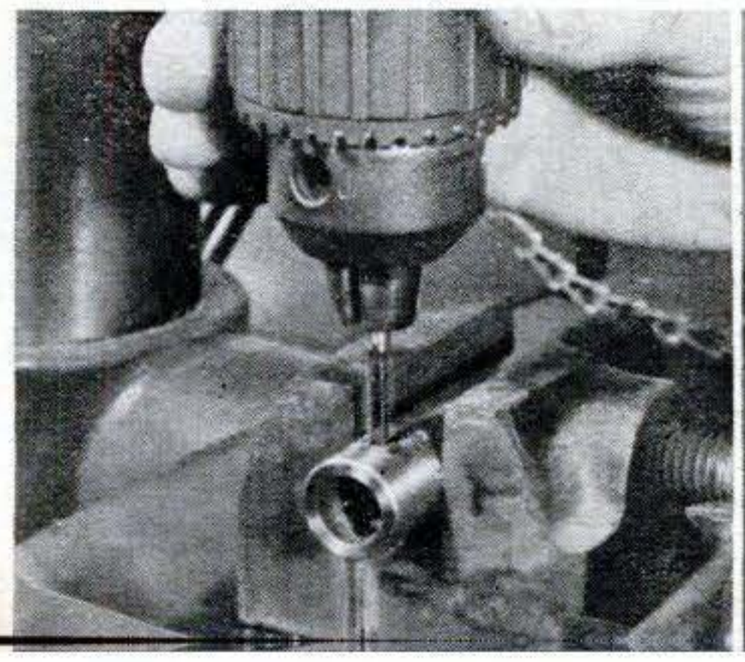
Setscrews align spindle. When you come to locking the spindle on the shaft, the four setscrews will permit aligning the two parts to avoid vibration. Back off the screw on one side and tighten the one opposite until the spindle runs dead true. A washer screwed under the ball bearing retains it.

Standard routing bits for a machine of this type have ¼" shanks, but such a variety of small bits with ⅛" shanks are available for use in hand grinders that I suggest making the adapter bushing also shown in the drawing. The filed slot lets the setscrew bear against the ⅛" shank.

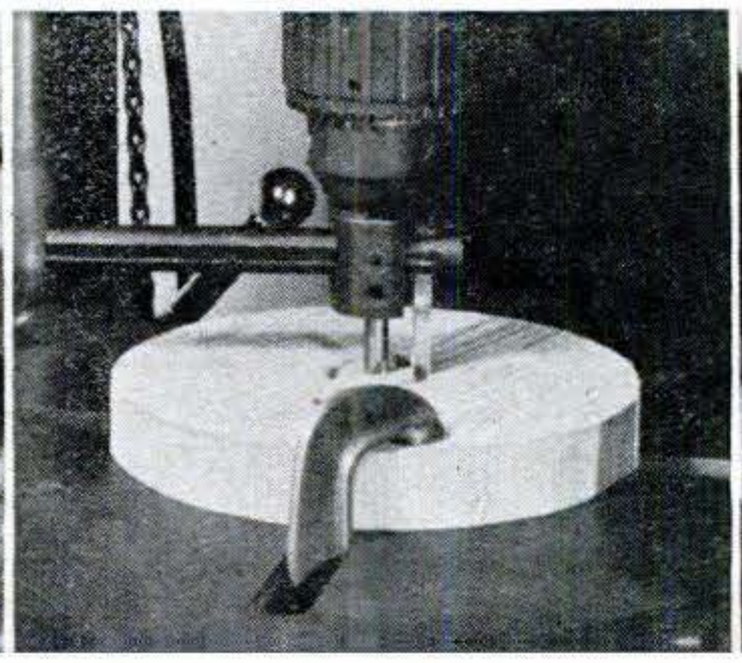
Making the body. Glue and screw two maple blocks 2⅜" high and about 2" wide and 6" long to the underside of the top disk, spacing them 2¼" apart. Cut away excess material with a bandsaw. END

Sharpening handsaws is mostly a knack. An article next month gives you tips.

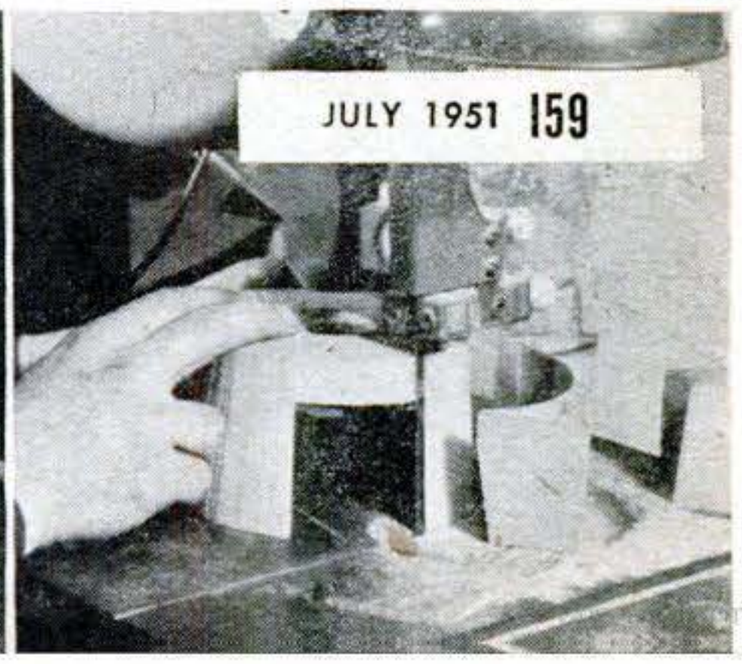
Rotated by hand, drill-press chuck holds tap true for tapping setscrew holes in spindle and sleeve of router.



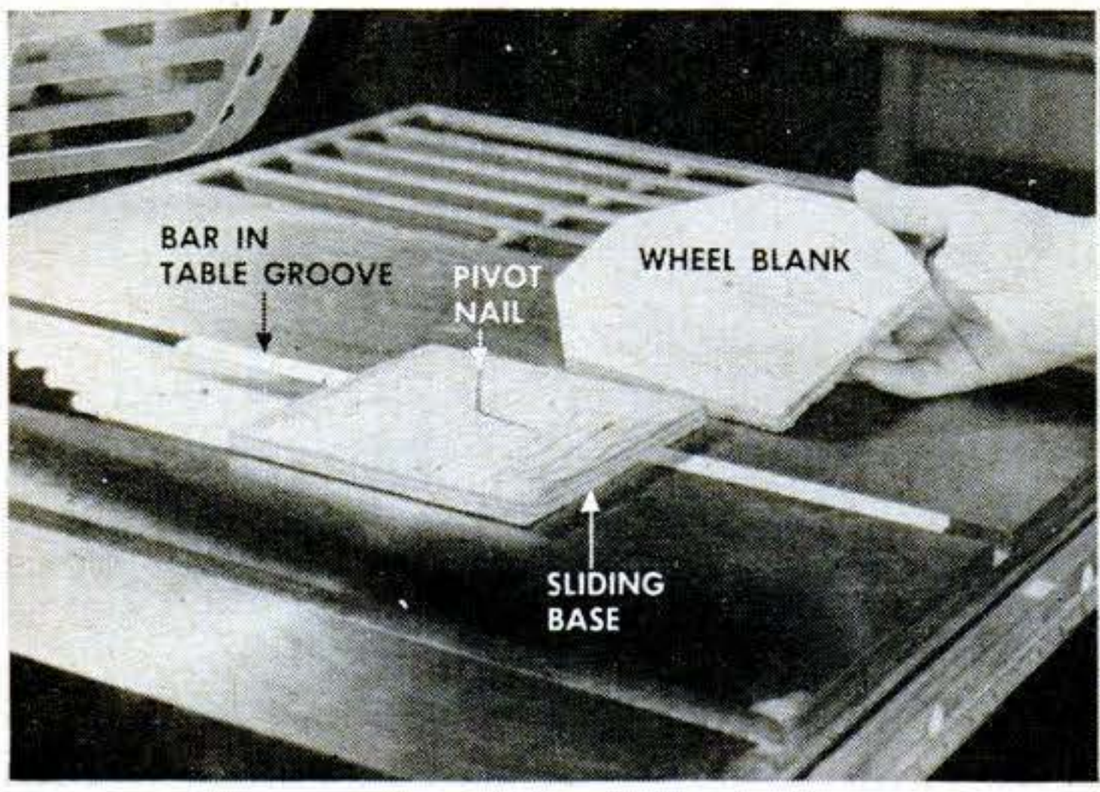
Use a circle cutter to outline bearing seat. Then bore through center and recess top. Bearing should fit seat tightly.

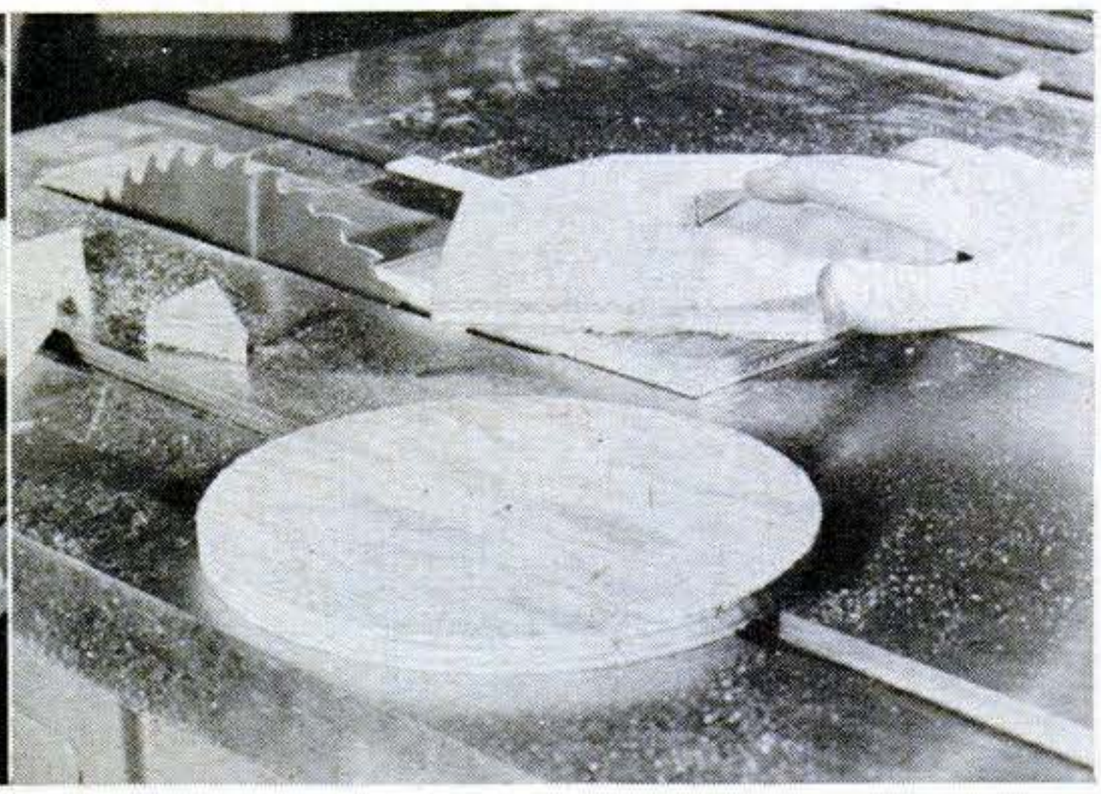


Cut body from glued-up blocks. Tilt bandsaw to 5° for this. Sand all surfaces smooth and round off vertical edges.



Straight Cuts on Circular Saw Shape Perfect Round Disks



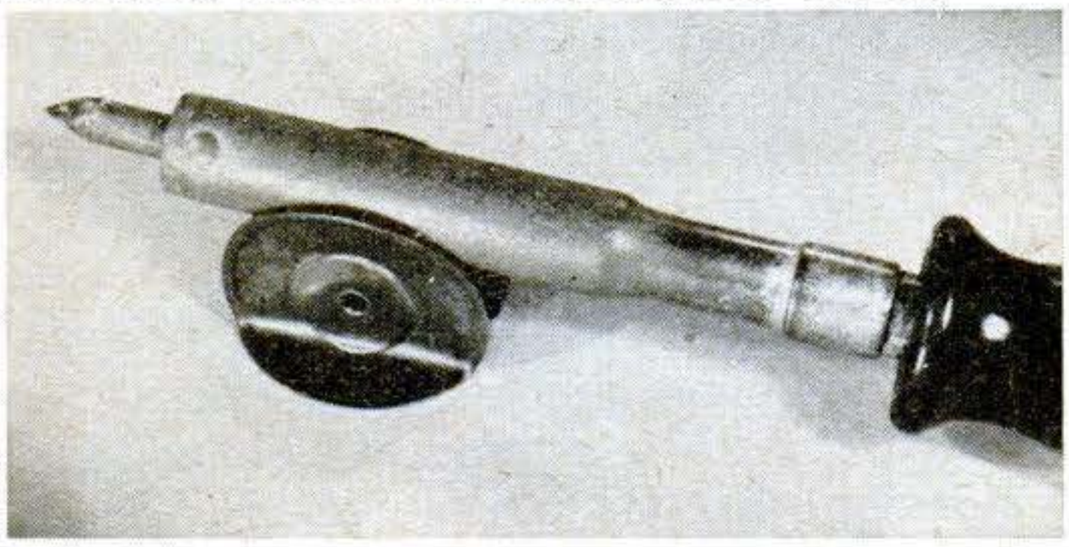


You don't need a lathe or a bandsaw to cut perfectly round wheels or disks. When I had to make several recently, I used a circular saw. Here's how:

Find or rip a strip of wood that will just slide nicely in the table groove. Nail a piece of plywood or other thin stock to it, positioned to pass near the saw blade. Then measure from the blade the radius of the desired disks, and on this spot drive a longer pivot nail through from the back.

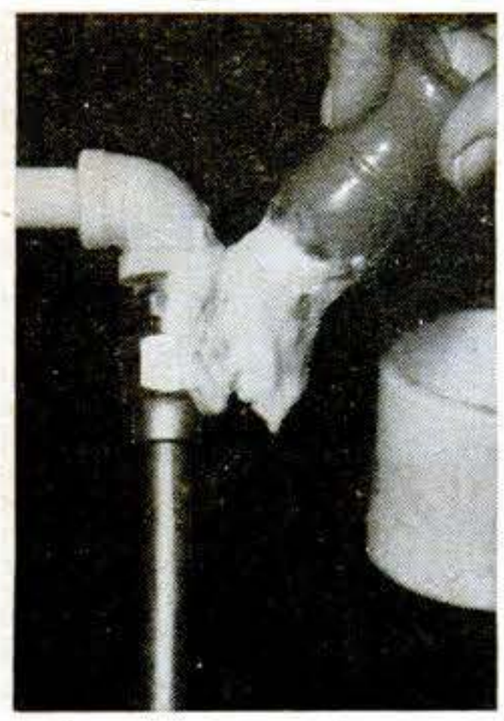
Wheels can be cut from odd-shaped scraps of wood. Drive the blank on the nail, hold it so that it can't turn, and saw off a corner. Turn it, cut off the other corners, then the new corners, and so on. Do not turn the work during the cut until you have almost a true circle. Then hold the slide stationary with the teeth touching the disk, and slowly turn the latter. The result is a perfectly true, smooth-edged disk.—*Edward Weber, West Leesport, Pa.*

Hot Iron Rests on Typewriter Spool



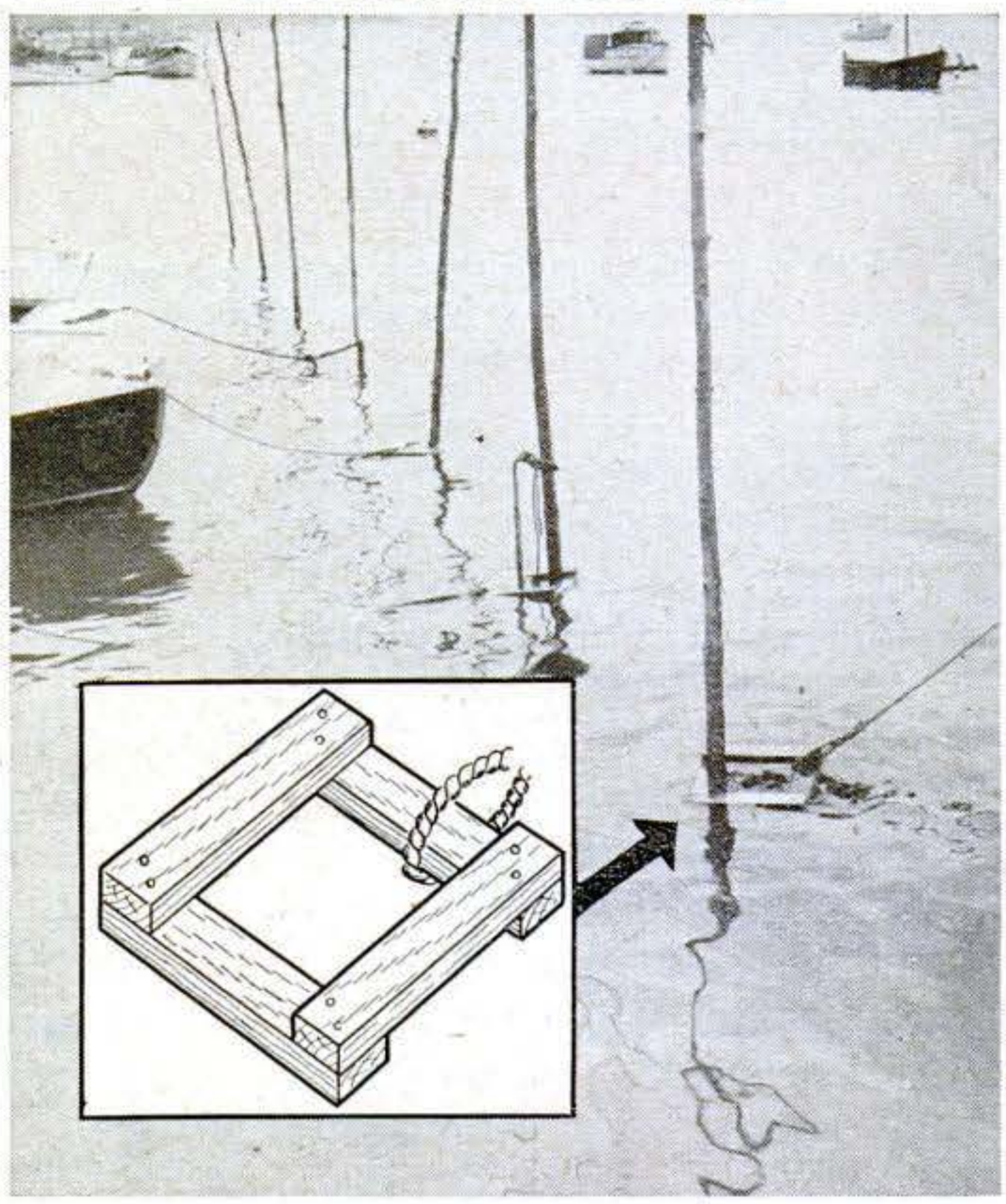
A HANDY stand for a soldering iron can be made by bending a metal typewriter-ribbon spool as above to form a base. Also flare the upper edges to receive the iron.—*John J. Rea, Urbana, Ill.*

Testing Gas Connections for Leaks



WHEN making gas connections, don't forget that an accepted way to test them is with soapsuds. Apply the suds to the new or refitted joints and watch for telltale bubbles. If no bubbles appear, there's no gas escaping.—*Ivan Grosvenor, Richmond, Ind.*

Collars Let Boat Rise with Tide



HERE'S a way to moor a boat with tight lines—yet the boat is free to rise and fall with the tide. Use two wooden collars, one for the bow line and the other for the stern. Slip the collars over stakes. The floating collars will rise as the boat does.—*Elon Jessup, Woods Hole, Mass.*

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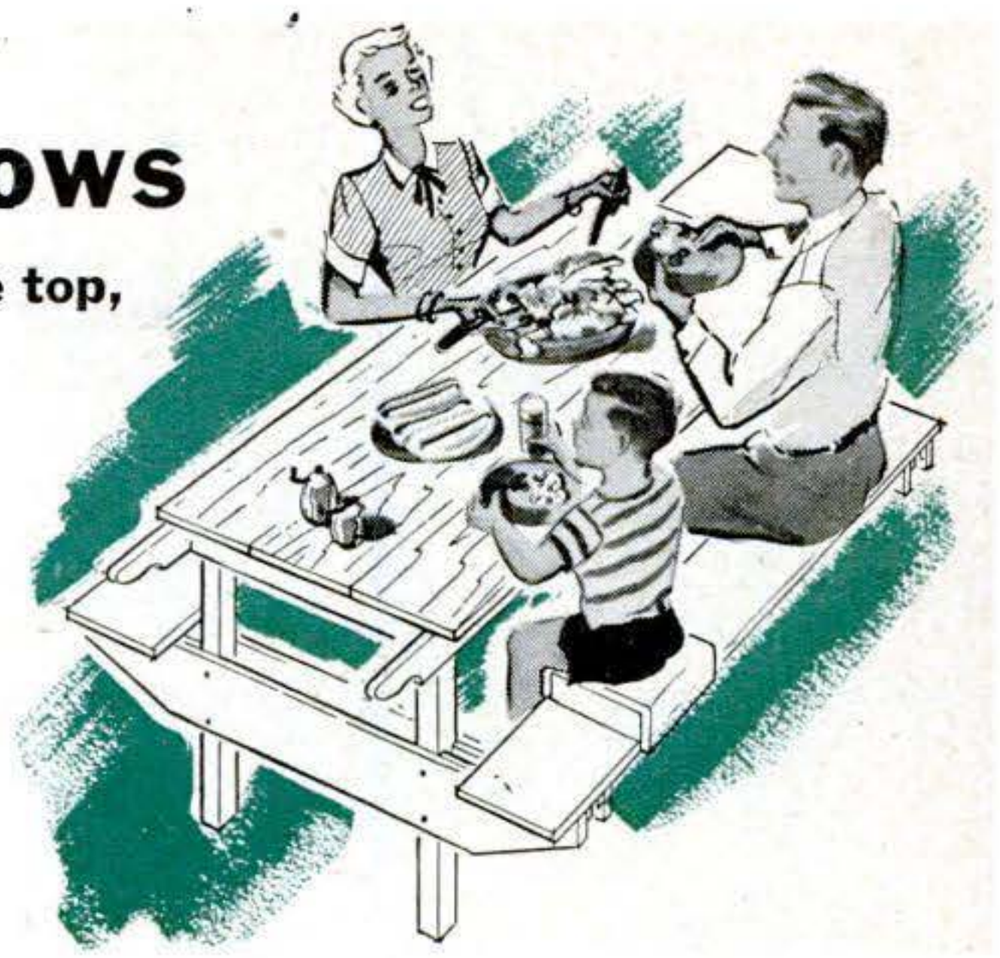
This Picnic Table Grows

Leaves that pull out at each end enlarge the top, and sliding benches make it easy to seat yourself at this table.

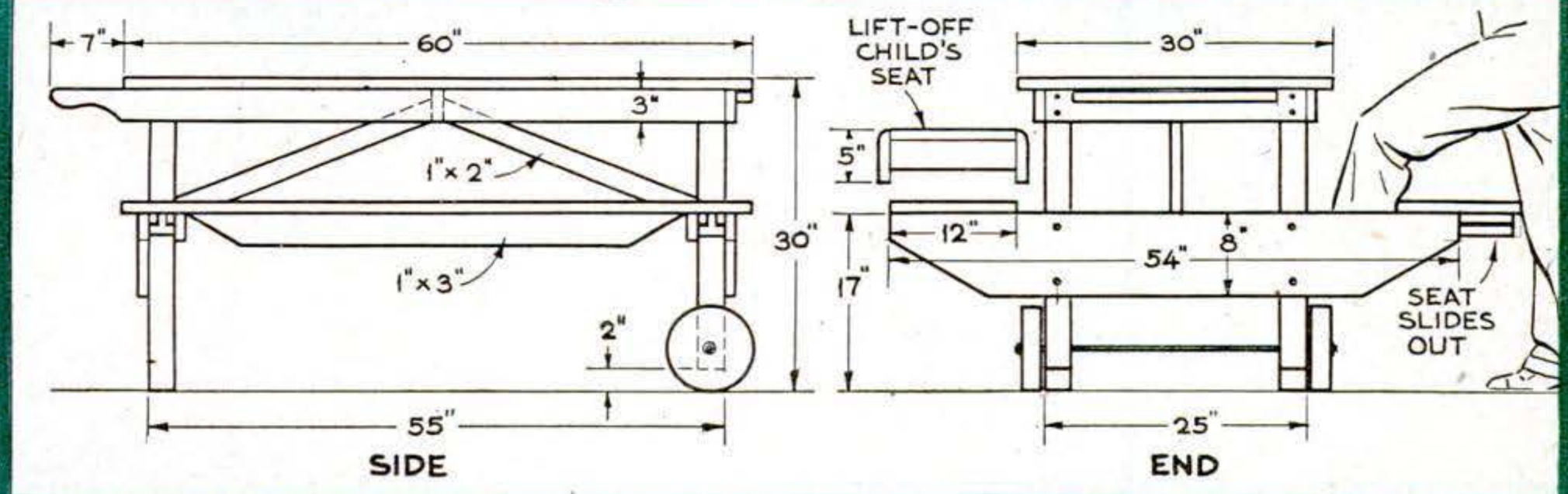


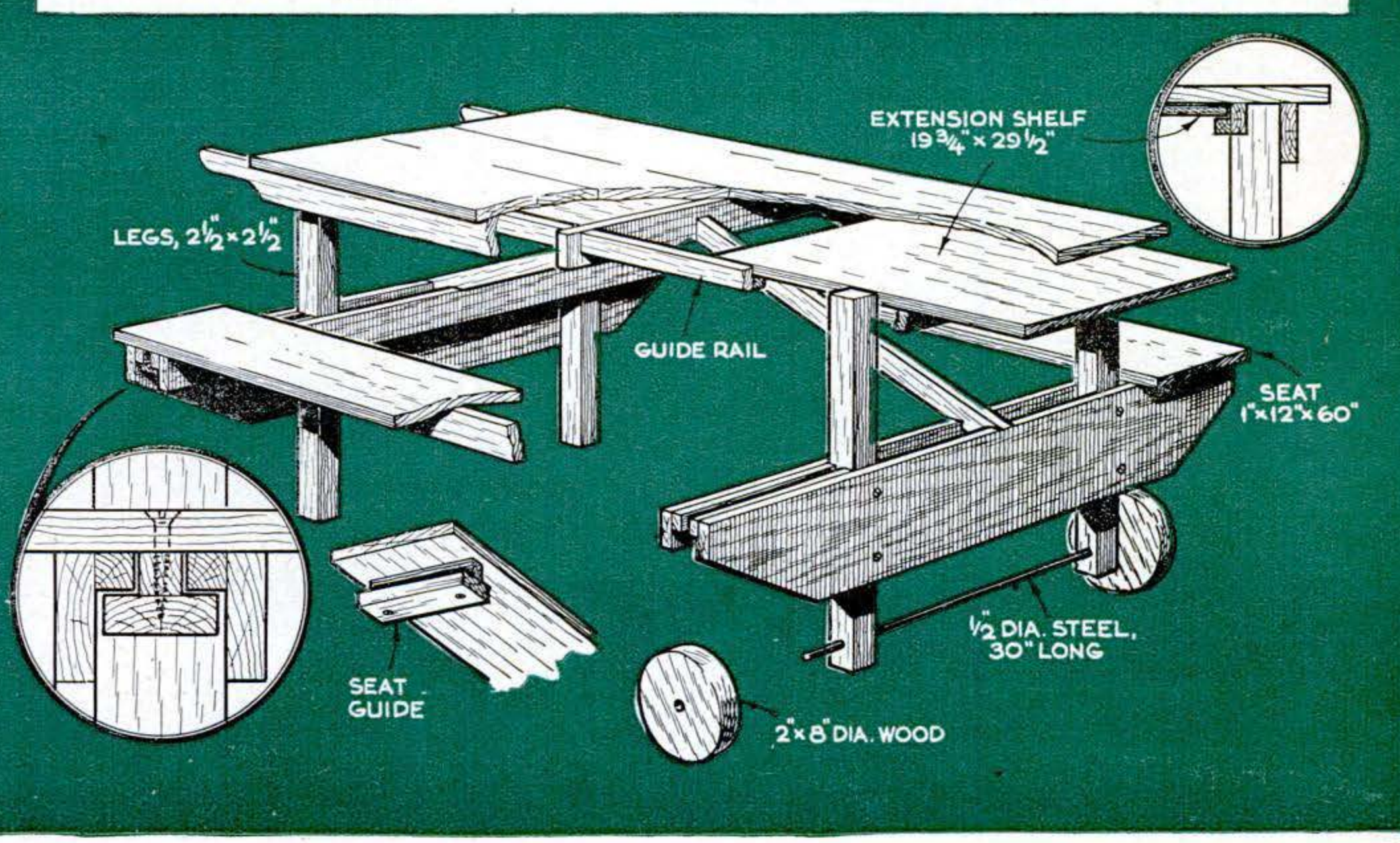
ALTHOUGH it's only 5′ long, there is plenty of space on this table top when the leaves are extended. Another feature is the child's booster seat that brings his chin well above the board. Then, too, the wheels make it easy to move the table to any part of your yard.

For the top and seats, pine will be satisfactory. Outdoor plywood should be used for the leaves. These slide on guide rails, as shown in the sketch. A stop should be provided so the leaves can't be pulled all the way out. Fit the guide rails loosely so there won't be any binding.

Saw the wheels from 2″ stock. If the wood tends to split, screw hardwood cleats to the outside of the wheels. Cotter pins over washers hold the wheels on the axle.

Assemble the table with screws and glue. With such construction, you won't have to wheel the table inside out of the weather.—*Hi Sibley, Nuevo, Calif.*





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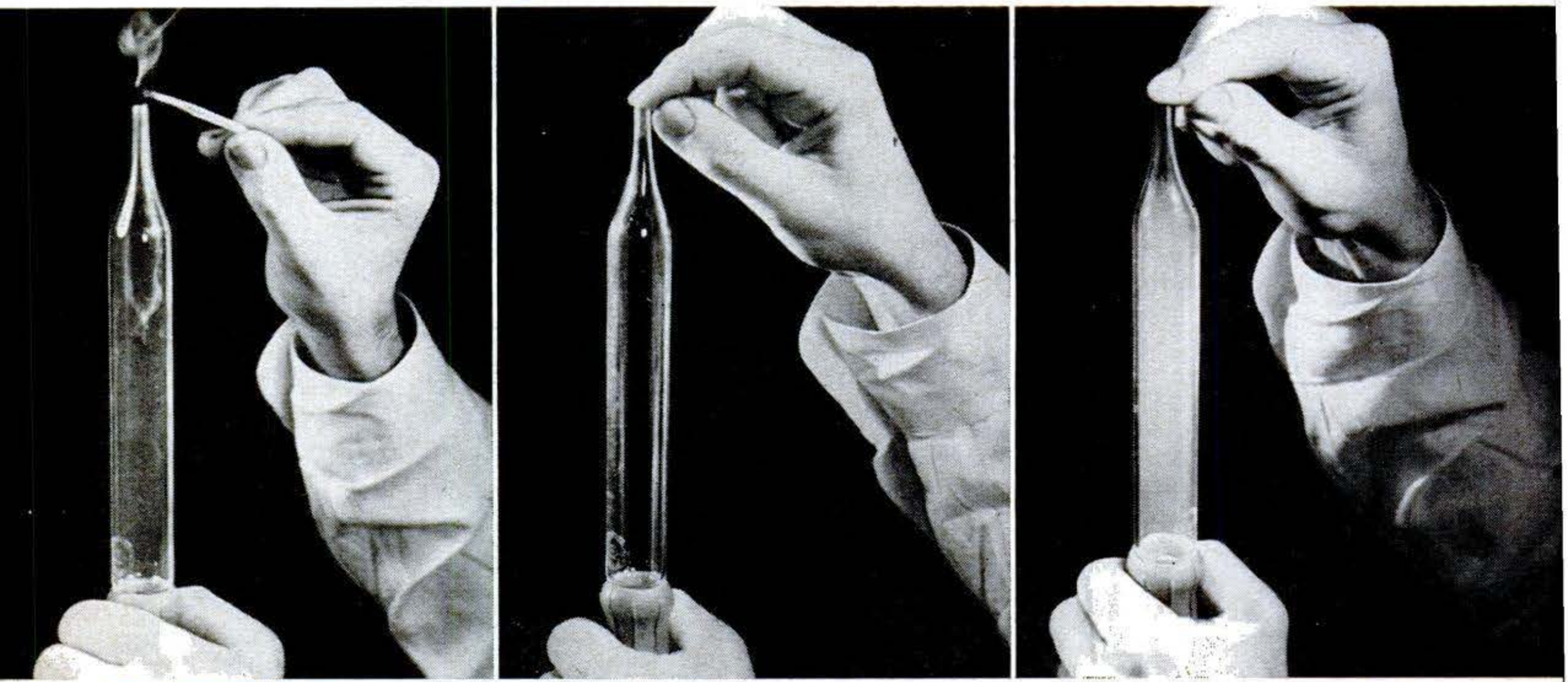
What Keeps Refrigerators



COMPRESSION of a gas produces heat, while expansion cools. Half fill the bulb of a meat baster with water, invert the baster, and draw into it a wisp of smoke from a match to provide nuclei for cloud formation.

Hold a finger over the open end to seal it, squeeze the bulb hard, and any slight mist in the tube will disappear (center photo above). Compression of the bulb warms the air in the bulb by crowding it into a smaller space. The warmed air absorbs the moisture.

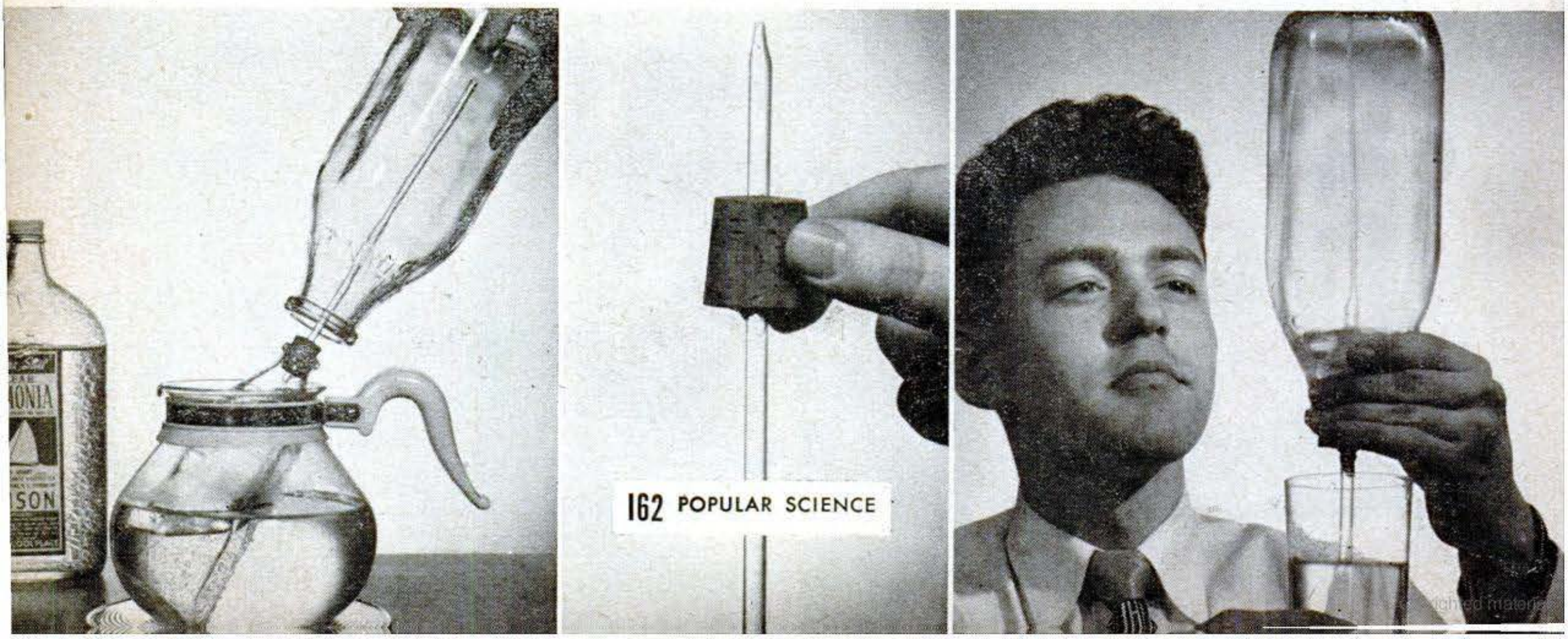
Release bulb and a cloud appears, as in right-hand photo above. Expansion of air has cooled it, squeezing out excess moisture. In an electric refrigerator, same principles apply. Heat is squeezed out of refrigerant vapor by compressing it until vapor is hotter than air around it and heat thus can be dissipated. Expansion of refrigerant then produces cooling.

ABSORPTION of a gas by water and the use of heat to drive the gas out again—as in a gas refrigerator—can be demonstrated easily with simple equipment.

You'll need an 8-oz. baby bottle fitted with a 1-hole stopper and an 8" glass tube; and a milk bottle fitted with a cork through which passes the glass of a long medicine dropper (center below). File down the jet tip so the hole is about ⅛" across.

Put 2 oz. of ammonia in the baby bottle, insert the stopper, and stand it in boiling water, away from the flame. As ammonia bubbles begin to appear, invert milk bottle over tube.

A strong whiff of ammonia will tell you when the milk bottle is full of gas. Remove it carefully, keeping it inverted. Place a small wad of wet cotton on the inside end of the stopper and insert tightly. Quickly dip lower end of the dropper into a glass of water. As soon as a little ammonia dissolves in the wet cotton, water will rise in the dropper. When water starts to come out of the jet, the vacuum produced by the dissolving ammonia will become so strong that the water will spurt out spectacularly like a gushing fountain.



Frigid?

Entertaining and enlightening experiments explain the ancient science of artificial cooling.

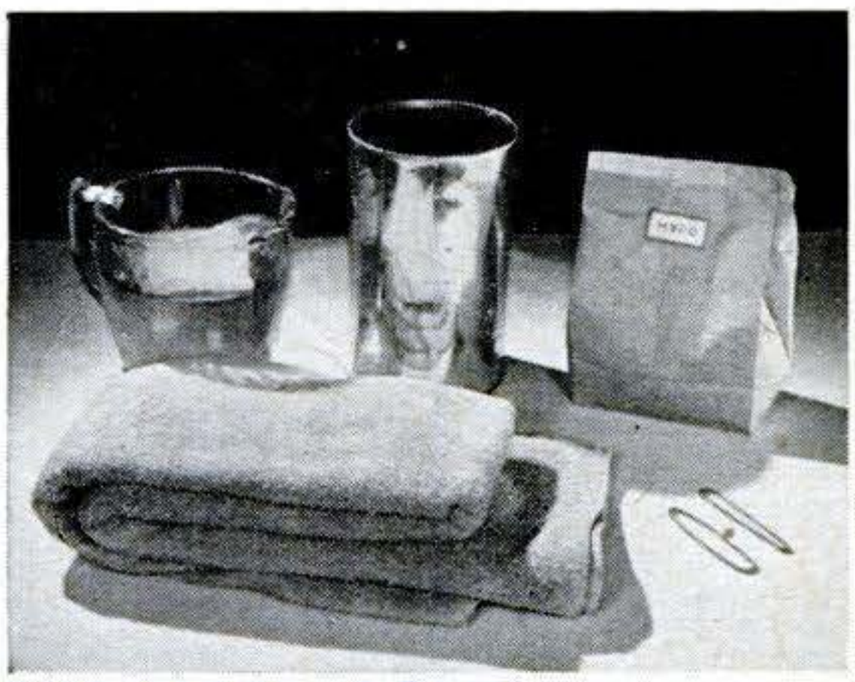
By Kenneth M. Swezey

WHETHER your refrigerator is so new it still amazes you, or so old it still uses ice, it keeps things cool the same way that nectars were cooled in Biblical times. A solid melts or a liquid evaporates—and thus snatches heat from things nearby.

The notion that a freezer unit or a chunk of ice puts cold into your refrigerator is the reverse of the truth; the actual job of both is to remove heat. In a mechanical refrigerator, heat from the box and its contents causes a liquid to evaporate in the cooling coils; the vapor then carries this heat away. In an ice box, heat from the food and box melts the ice and is carried out by the drain water.

The ancient Egyptians set out porous earthenware jars filled with water. During the night, dry desert breezes evaporated moisture seeping through the pores, chilling the water inside—just as a breeze chills you when you perspire.

The refrigerator in your kitchen is a glorified version of those jars. Its insulated walls keep out room heat and its pumps, coils, and radiators hasten the cooling. It can cool things below the freezing point of water (to make ice cubes, for example) because its refrigerant changes from liquid to vapor—and carries away heat—at temperatures below freezing.

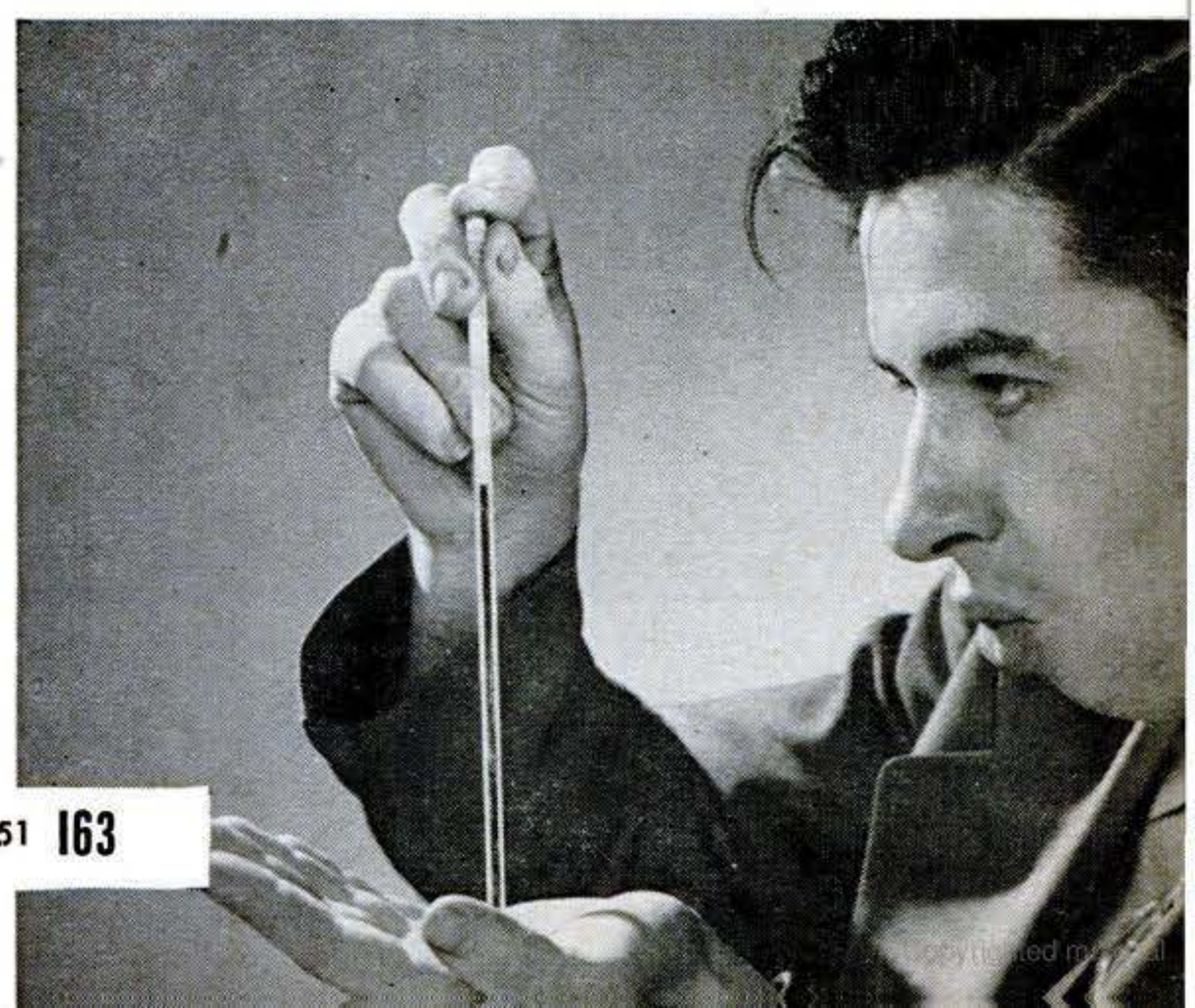


CHEMICAL COLD can be demonstrated this way. Wrap a folded towel around the sides and bottom of a large tin can for insulation. Pour in a quart of the coldest water you can get, dissolve a pound of photographic hypo in it by rapid stirring, and put a bottle in it to be cooled. Temperature of the bottle should be lowered about 25°, that much heat being taken from the water to make the hypo dissolve.

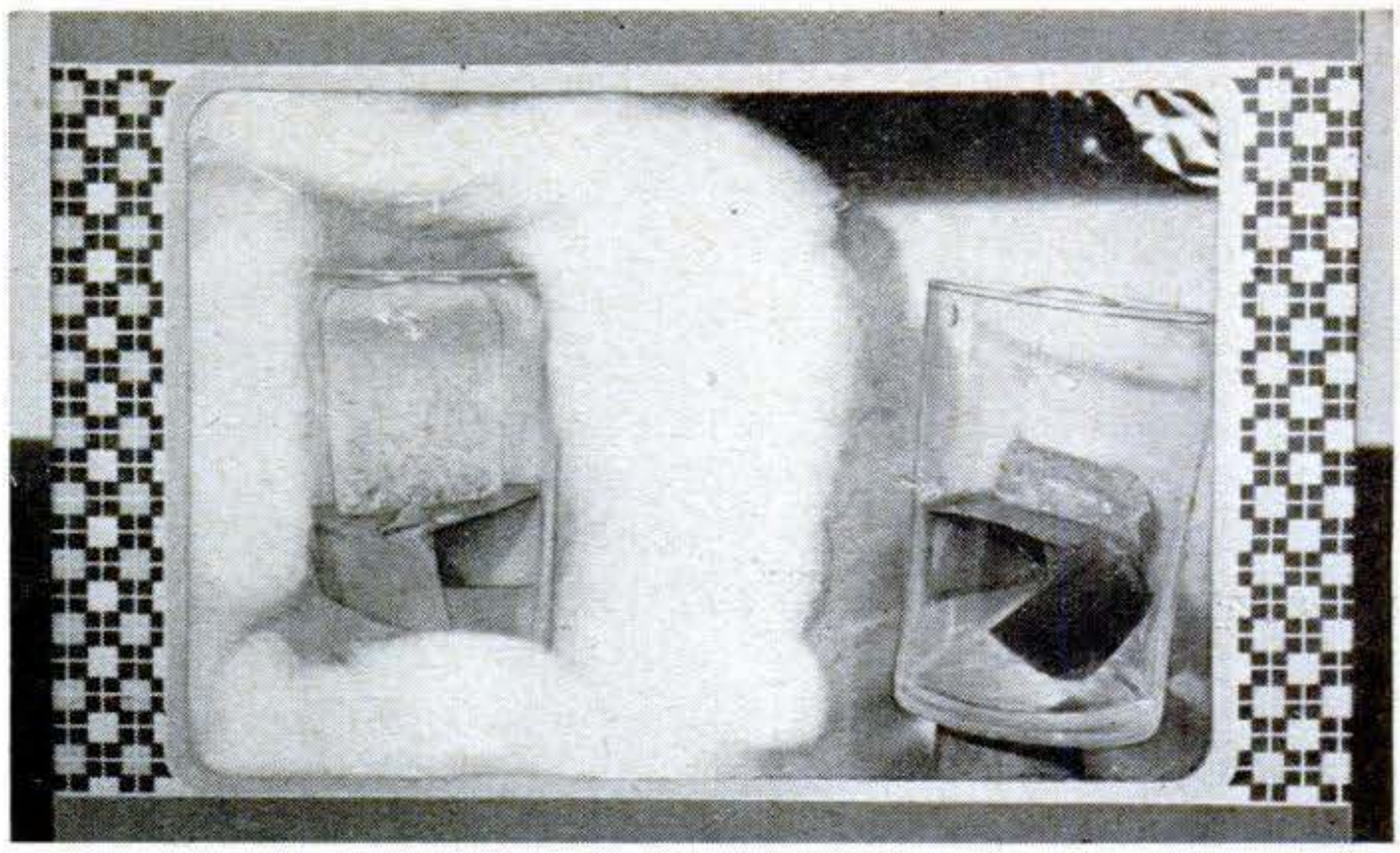
Common refrigerants are liquefied ammonia, sulphur dioxide, and Freon-12 (dichlorodifluoromethane). They are poisonous and expensive, so means are provided to use them over and over in a completely closed system of piping. In an electric refrigerator, the heat-saturated vapor is changed back into a liquid by first squeezing it with an electrically driven compressor to concentrate its heat, and then discharging this heat into

ICE-MAKING process in an electric refrigerator can be demonstrated with a Freon-actuated "bug bomb" and a tube moistened with water on the outside. Hold the tube with a clothespin to keep from heating it or freezing your fingers, and let gas spray through it. In a few seconds, the boiling and expansion of the low-boiling Freon will freeze the water on the outside of the tube.

HEAT THIEF Whenever a liquid evaporates or boils it steals heat from its surroundings, thereby cooling them. You can prove this by pouring out a small pool of rubbing alcohol in your hand and standing a thermometer in it. Now blow across the alcohol to speed evaporation. Within a minute, the temperature of the alcohol will drop as much as 10°.



INSULATION in refrigerators and ice boxes saves money by slowing passage of heat through walls. You can prove this with ice cubes and a cardboard cake box that has a transparent cover. Line half of the box with cotton. Put an ice cube on a bent-cardboard shelf in a glass and imbed the glass in the cotton. Stand an identical glass and cube in the bare half of box. Observe the ice through the cover. The ice in the insulated half of the box will still be going strong long after the other cube has melted.



the room through radiator fins. In a gas-operated refrigerator, the vapor (in this case ammonia) is first absorbed in water, then separated from the water by boiling, and finally condensed once more by giving off its heat through a radiator.

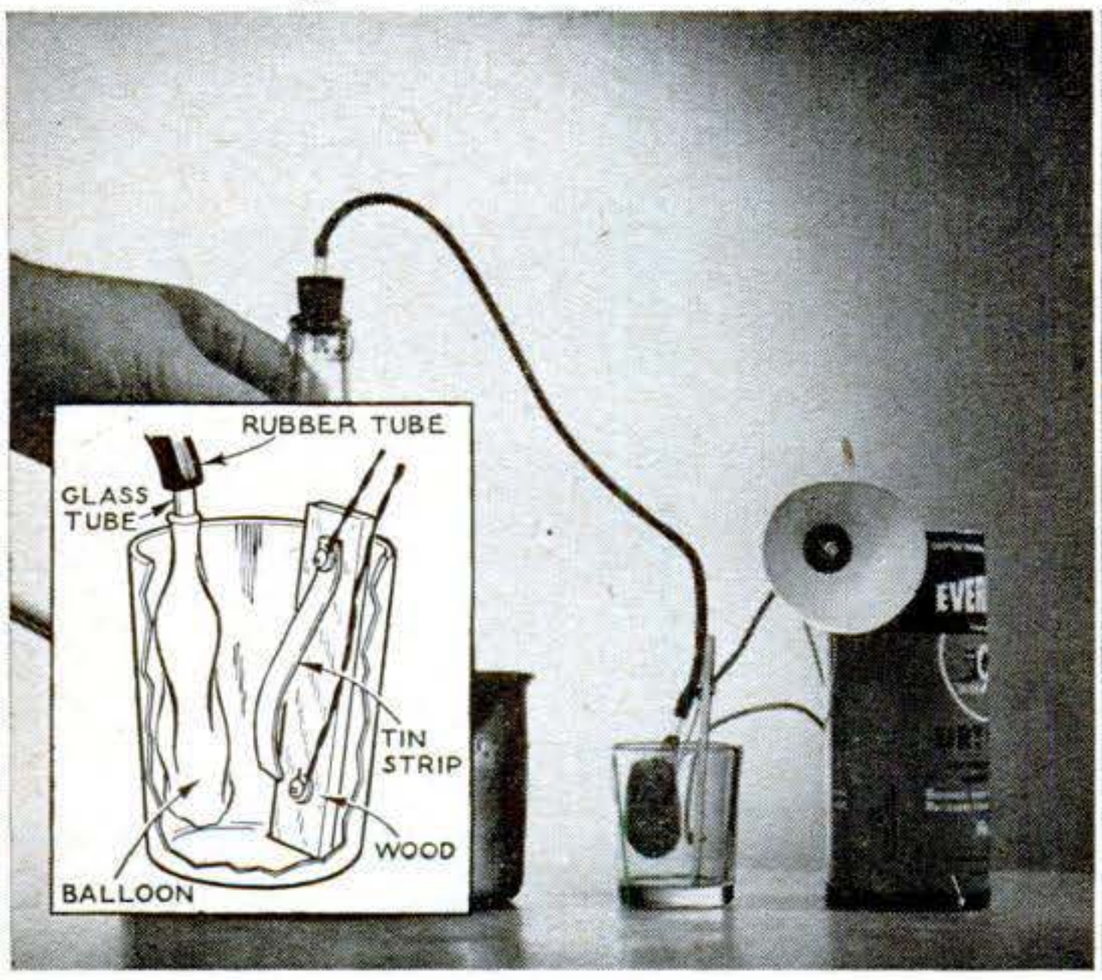
The mechanical watchdog that maintains the temperature you want is the thermostat. It may be a bimetallic strip that bends with changes of temperature, thus working a switch to turn on and off the compressor motor. Or it may be a capsule of low-boiling liquid mounted in the freezing compartment and connected by a tube to a bellows attached on an electric switch or a gas valve. As the capsule heats up, the vapor in it expands and inflates the bellows, thus turning on more gas or starting the compressor.

Only about 18 percent of the cost of operating the average home refrigerator goes actually for cooling food. About 5 percent is accounted for by air spillage from opening and closing the door, and about 77 percent is lost through the insulation, joints, and frames. Much of this leakage is useful; it gives a temperature differential between the food storage and the freezing compartments so the food doesn't freeze.

Try some of the easily performed demonstrations illustrated on this and the previous pages and you will understand artificial cooling much better.

THERMOSTAT experiment can be performed with this simple setup. Connect a pop bottle to a small balloon with a rubber tube. Place the balloon in a tumbler next to the blade of a spring switch made as shown. Connect switch in series with a small bulb and a dry cell. To operate, set the bottle in a pan of ice water (to represent a cold freezing chamber), inflate the balloon a bit, and insert the stopper in the bottle. The light (representing the compressor motor) remains unlit, since bottle (refrigerator) is cold.

Now lift the bottle from the water. As soon as it warms up, the expanding air blows up the balloon, the balloon presses the switch, and the light lights. Put the bottle back in the water and it goes out again. Commercial thermostats are made more sensitive to temperature change by substituting for air a liquid that boils at low temperature.



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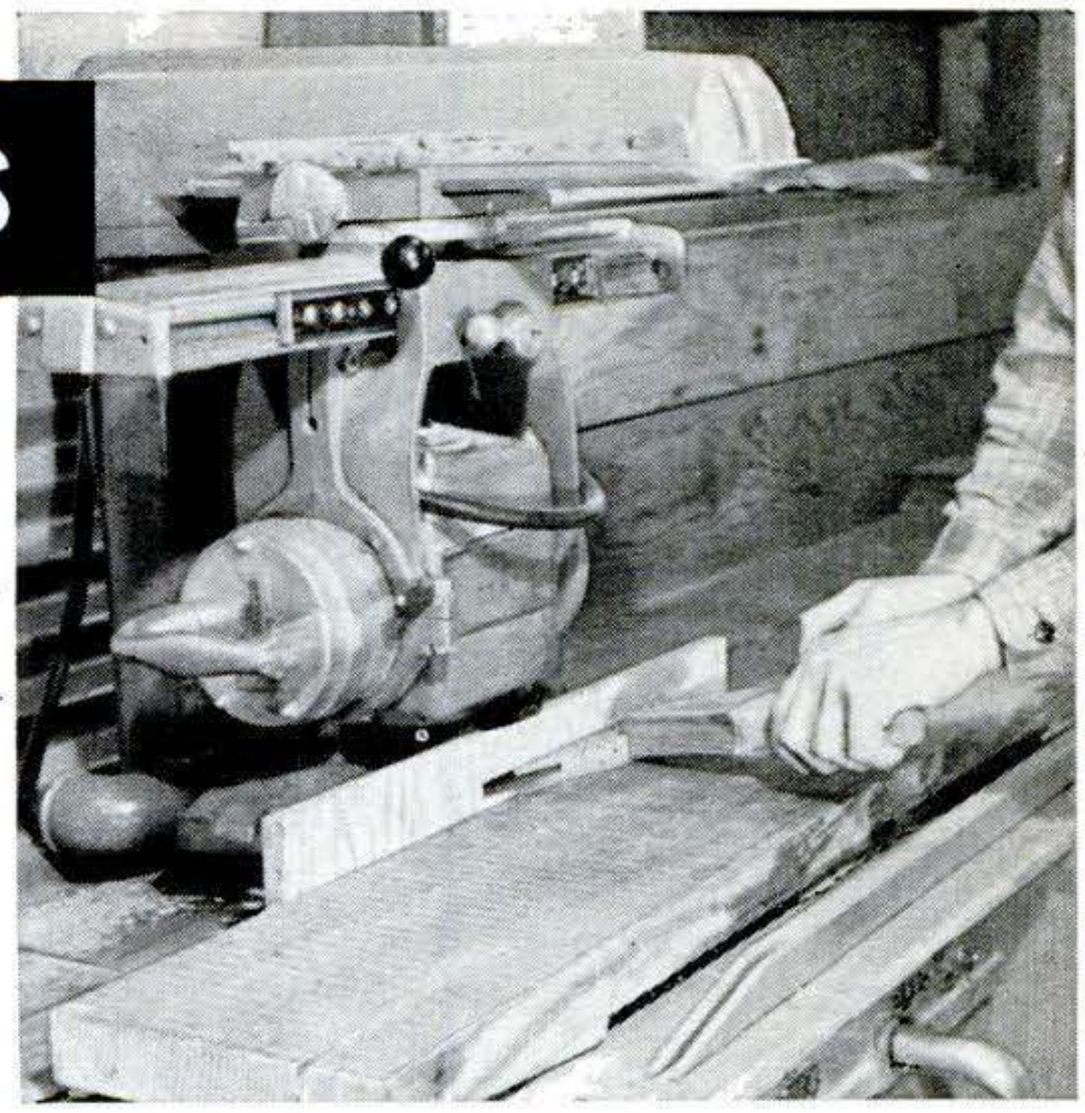
Tips for Woodworkers

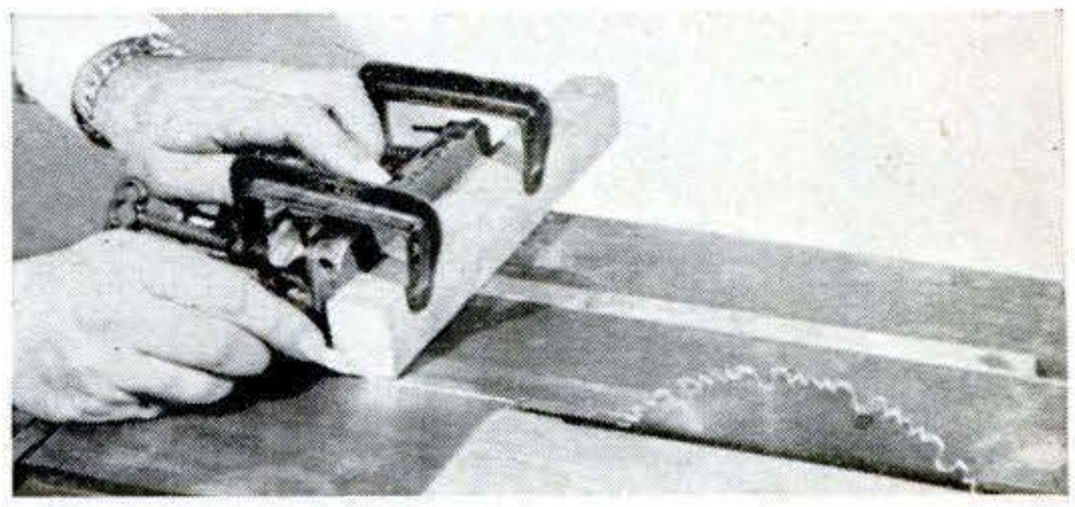


Cutting Slots with a Radial Saw

CUTTING tongues and grooves and slots with a radial saw is a problem, since there is no satisfactory way to clamp on an auxiliary fence. Using some ¾″ plywood and a piece of two-by-twelve, you can nail and glue together this special fence. The plywood extends below the two-by-twelve so it can be held in place with the same wedges that hold the regular fence. The slot that the dado blades turn through is formed automatically the first time you use the fence.

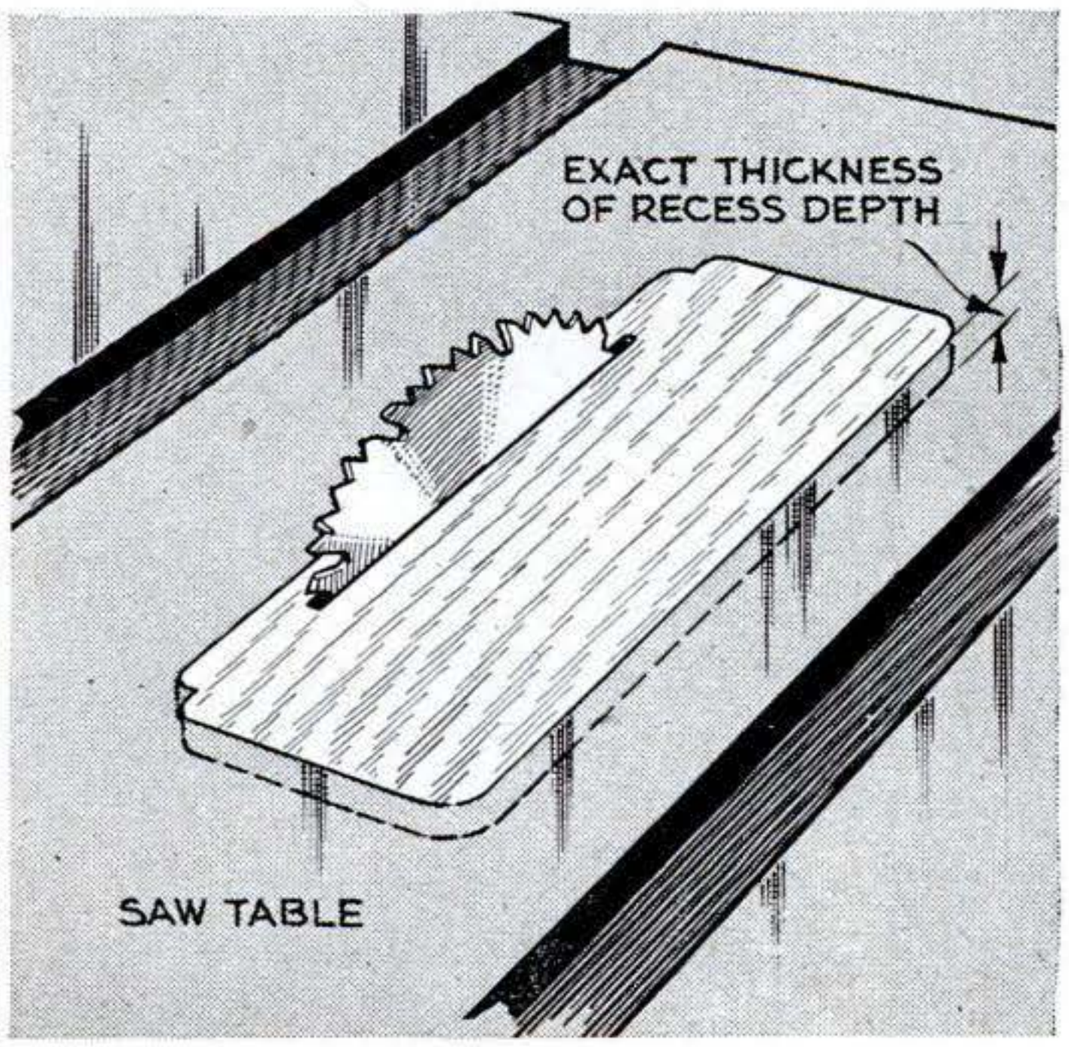
Scribing Line on Saw Table

HERE'S an accurate way to scribe a line on your saw table to show the line of cut. Clamp a scrap of wood to the miter gauge. Run the saw and cut off an end of the scrap. Then hold a pencil as shown in the photo and pull the gauge to the table edge.—*Louis Hochman, Sherman Oaks, Calif.*



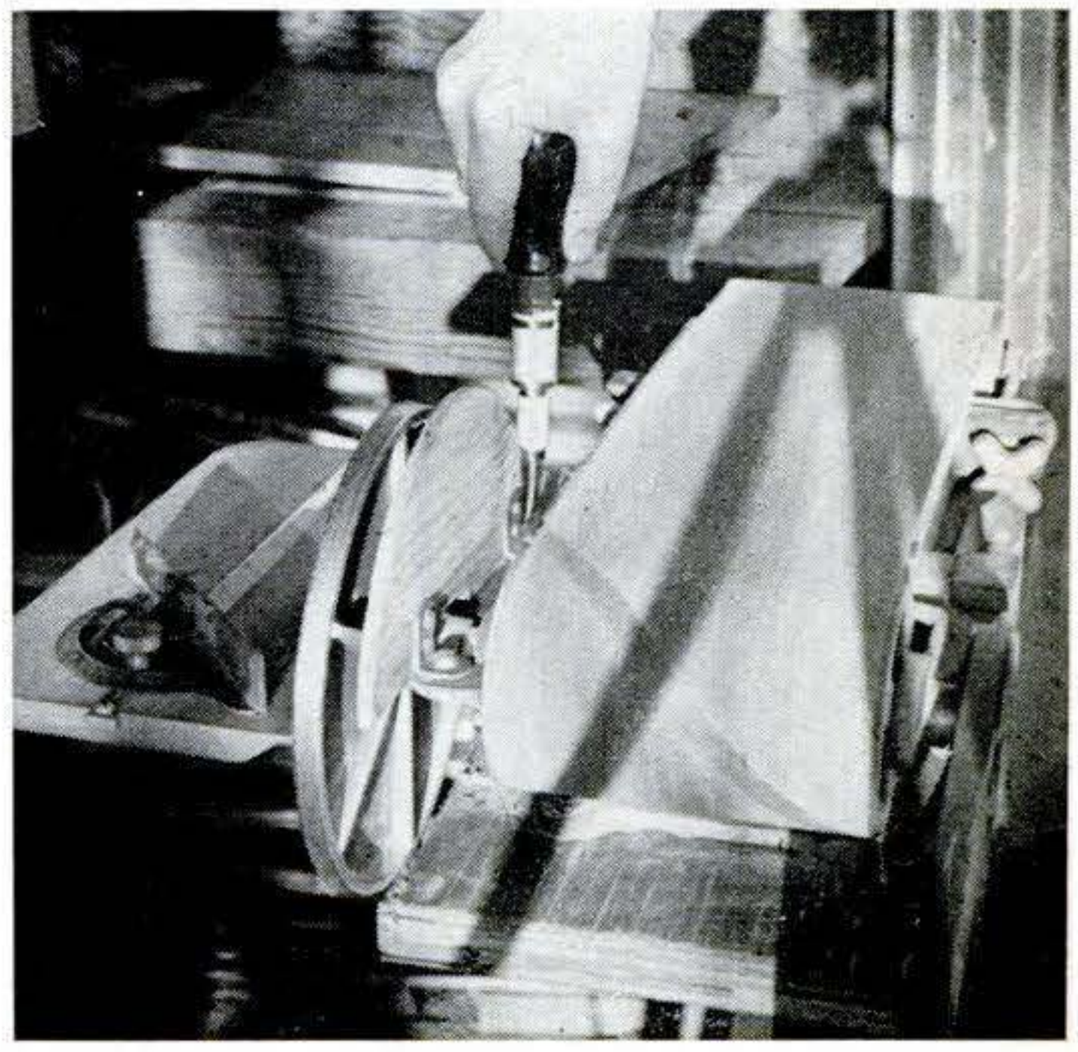
Ripping Narrow Stock on a Saw

IT IS difficult to rip narrow strips on a circular saw because the blade grabs the work and pulls it down through the slot in the table insert. To avoid this, substitute a snug wooden insert for the metal one, as below. Let the blade cut its way through the wooden insert by raising the arbor or by lowering the table. With this setup you can rip strips as narrow as 1/32″.



Sander Guard Protects Fingers

THE ribs on the back of the disk on a combination sander like the one below can be dangerous. Even a careful operator can bruise his fingers on the fast-moving ribs while handling wide stock on the belt. After learning the hard way, I made this guard. It's a half circle of ¼″ plywood. Bolts and two L-shaped metal brackets hold it in place.—*Darrell Huff, Sonoma, Calif.*



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"Kittens" A. Aubrey Bodine's most accepted work — 51 salons, top honors in several. Tinfoil reflector held kittens' attention.

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How to Take Prize Winning Pictures

By Ralph Reppert

An interview with A. Aubrey Bodine, the highly successful Baltimore photographer.

Even commonplace subjects make dramatic photos when you approach them from a fresh viewpoint—and here are examples to prove it.

A. AUBREY BODINE, one of the world's most widely accepted exhibitors of salon photographs—and winner of many big cash awards—ascribes his success largely to:

- Attention to details, and
- A fresh, new approach, whenever possible, to the subject he is photographing.

Maryland's Eastern Shore oystermen have been photographed hundreds of times in clear weather. But few photographers ever tried a foul-weather approach. Bodine did. On a morning when a new oyster bed was opened, he arose well before daybreak, chartered a boat, and cruised around in a cold rain to photograph the oystermen at work. It was a rugged way to approach a picture. That day's work won the $5,000 prize in a contest against 52,018 entries.

In the same contest two years later, he won second prize with his "Morning Charge." Learning of the proposed Baltimore Home Guard maneuvers, he got in

"Morning Charge" Baltimore home guard maneuvering in a smoke screen that Bodine arranged to improve picture.

"Greenspring Lane" First prize Photographic Society of America continental salon, third in North American International.

touch with a Chemical Warfare unit nearby and asked for smoke. The smoke made the picture.

Bodine's technique can best be understood if the steps are taken as they come:

When selecting material, he disregards the adage that babies, pretty girls, and animals are sure-fire subjects. He believes they are good enough for average amateurs to learn on, but average amateurs seldom win prizes.

Instead, he says, consider commonplace subjects—people, landscapes, monuments—subjects that have already been photo-

"Choptank Oystermen" $5,000 first-prize winner in Popular Photography's 1948 contest. Local honors throughout U.S.

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"Eclipse" Two negatives combined. Baltimore roofs shot on infrared film, sun exposed at intervals on second film. Camera movement caused break in the sun positions.

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graphed to death under ideal weather conditions. Then approach them in a drizzle of rain, after dark, or in the middle of a snowstorm. Any new approach to the oldest photographic subject in the world may reward the photographer with a distinctive picture.

The equipment he carries is modest —a 4″ by 5″ Speed Graphic, a 5″ by 7″ EK view camera, an assortment of lenses, two or three extension cords, tripod, EK Super Panchro Press Film, a tinfoil reflector, clothespins, a roll of toilet paper, a box of rubber bands. The clothespins frequently improve the drape of blouses. The toilet paper, wrapped around flash bulbs and held on with rubber bands, softens the light.

Bodine doesn't hesitate to take along a few props when they can help a picture. When photographing "Greenspring Lane," he had his wife don a Mother Hubbard dress and shawl and carry a basket. The costuming changed the atmosphere of the picture from an ordinary American rural scene to one suggesting a Corot landscape.

His file of cloud negatives is one of his most useful possessions. When he takes an interesting picture under an uninteresting sky, he fills in with one of his "filed skies." In making the print, he first exposes the negative just photographed, dodging out the sky part of the picture. Then he exposes the print to the sky negative, dodging out the lower part.

This file came in handy, for example, when he set out to prove that Maryland has scenery representative of every state in the Union by illustrating lines taken from "America, the Beautiful." Shortly after these pictures were published, a Baltimore meteorologist asked Bodine for several prints. Never, the meteorologist wrote, had he seen cloud formations more typical of Maryland skies. Bodine gave him the prints but didn't tell him those clouds had been photographed, years earlier, in North Carolina.

When taking a picture, Bodine uses a full, generous exposure. That makes the negatives easier to work. He prefers natural light, and uses multiple-flash lighting when he needs artificial light. He develops negatives a bit less than formulas specify, because of his generous exposures, and this gives him softer negatives.

As soon as a negative is fixed he examines it carefully. Dense areas then are reduced locally with Farmer's reducer applied with brush or cotton. Thin areas are strengthened by the local application of intensifier.

After achieving a well-balanced negative, he builds up the highlights with red dye. If the first prints show that the negative could be further improved, he soaks it in water and works on it again.

After his exacting work on the negative, he is pretty sure of his picture. So he prints with relatively few rejects.

[*Continued on page 198*]

ELECTRIC WATER HEATER

If water is cold, look first for a blown fuse. A wire may be broken or a connection bad. Or the thermostat may be improperly set or defective. On the type using a time clock (for off-peak operation), the clock may be inoperative. It is possible that a heating element may be burned out. On new installations, the plumbing and wiring connections may have been made incorrectly.

If there is not enough hot water, check for loss through dripping hot-water faucets. The thermostat may be set too low or not operating properly. The heating element may be defective or covered with scale that prevents proper functioning. The shortage may be due to waste by careless use. The heater may be too small for the requirements of the family. If it is a new installation, watch for improper wiring connections, excessively low voltage, and long runs of uninsulated pipe that waste heat.

If water overheats, check the thermostat for a high setting. Improper wiring connections in the heater or a defective and grounded element can also cause overheating. In the winter, when the furnace is operated, a furnace coil used with the hot-water heater will cause overheating of the water. The furnace coil should be removed.

If leaks occur, they may be caused by a corroded tank, poor plumbing connections, a loose element, or a defective element gasket. Tanks sometimes rupture due to excessive pressure. A pressure-relief valve or a pressure regulator will protect the tank against this danger.

If water is rusty or dirty, it could be due to rust or dirt in the water main or house plumbing. Corrosion in the tank will also cause rusty water. If the tank has anode protection against corrosion, a new anode may be installed when the old one is used up. Excessive water temperature may discolor the water. The tank should be flushed periodically to remove accumulated dirt and rust.

If the electric bills are too high, it may be because of leaky faucets, careless use of hot water, or an excessively high thermostat setting. Long runs of uninsulated hot-water pipe may waste as much as a third of the electricity used to heat water. A furnace coil connected to a hot-water heater will work in reverse and cool the water during the summer when the furnace is not in use. A furnace coil should not be used with an electric hot-water heater.

(From *Electrical Appliance Servicing* by William H. Crouse)

FOR YOUR POPULAR SCIENCE INFORMATION FILE

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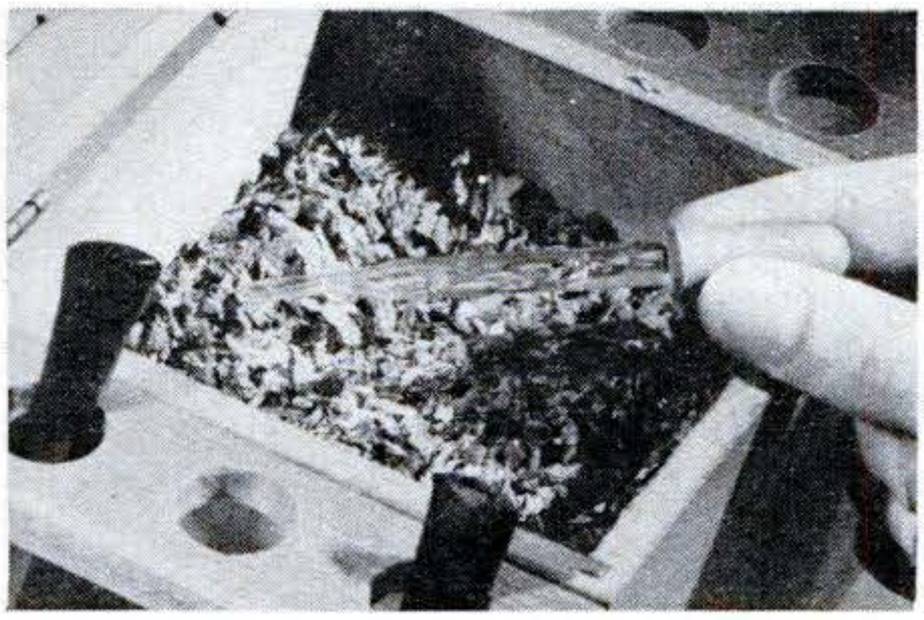
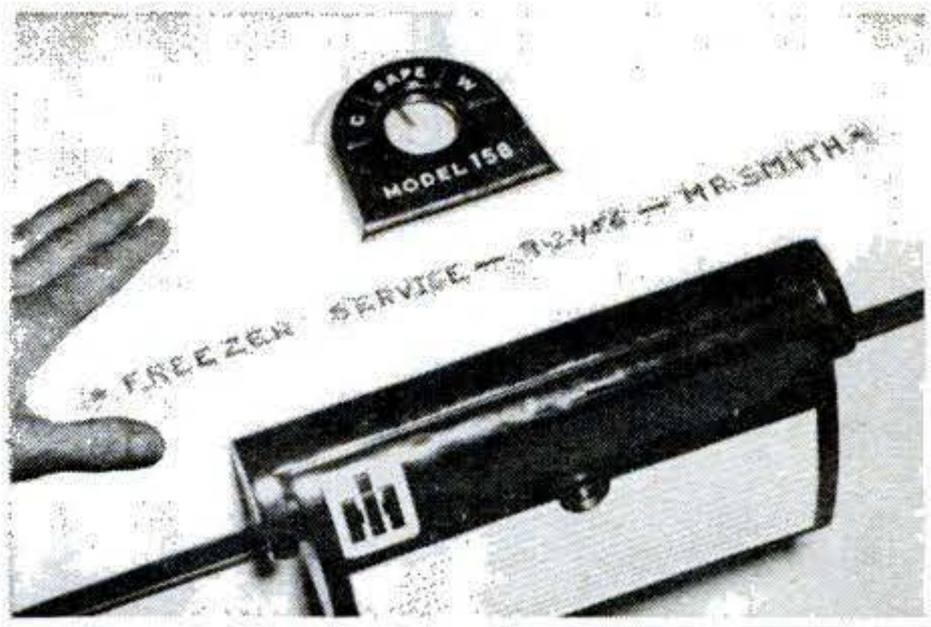
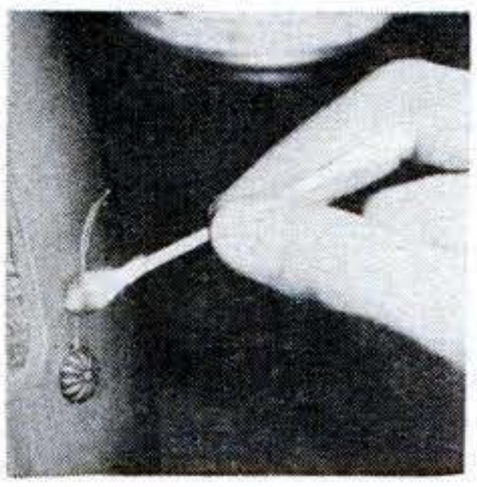
DO IT THE EASY WAY



To keep pipe tobacco moist, place an eye dropper almost full of water in the container—making it a humidor. Replace the water as it evaporates.

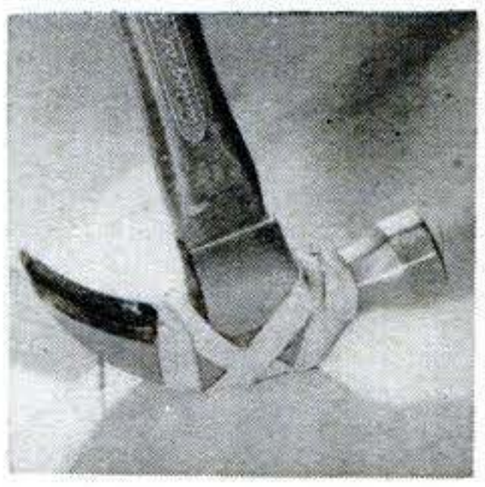


To keep the telephone number of your freezer serviceman handy, print it on a piece of freezer tape and stick it to the freezer as shown above.



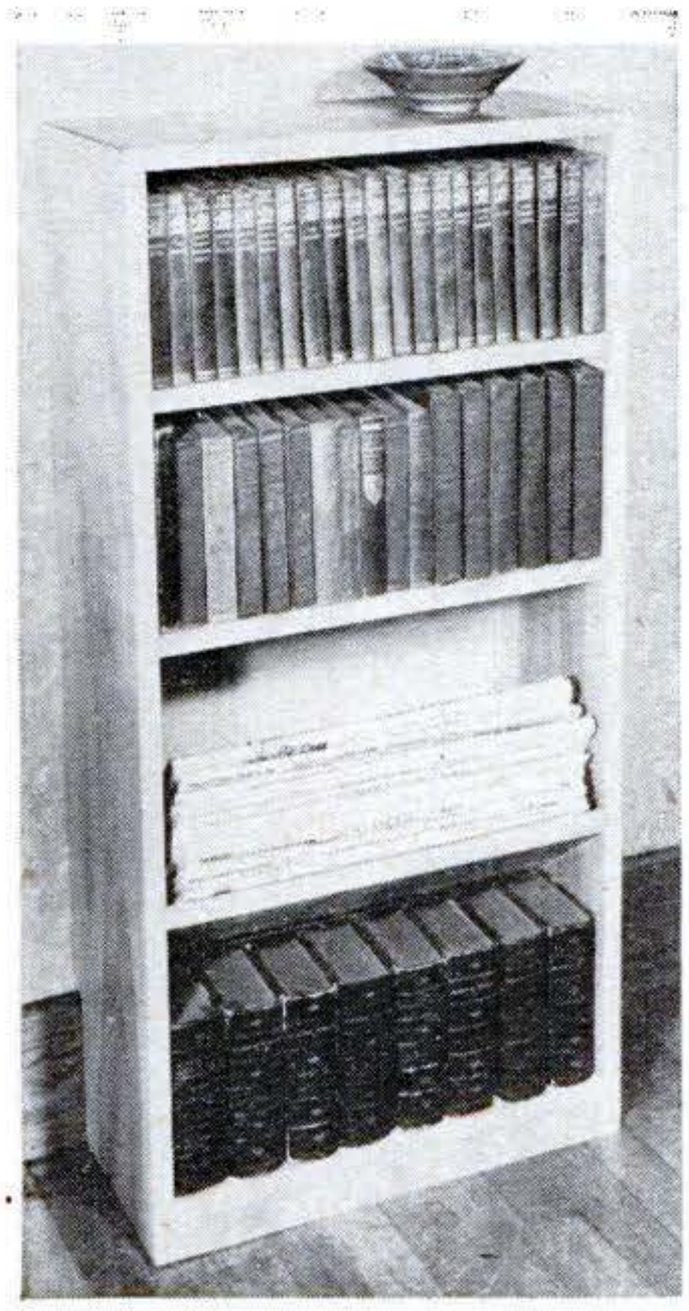
To touch up small scratches or chipped spots on woodwork, furniture, and kitchen appliances, use medical cotton tips or swabs. They make fine disposable brushes.

To protect the face of the wood when pulling out nails, cushion the hammer head by criss-crossing a heavy rubber band—or a piece of inner tube—over it.



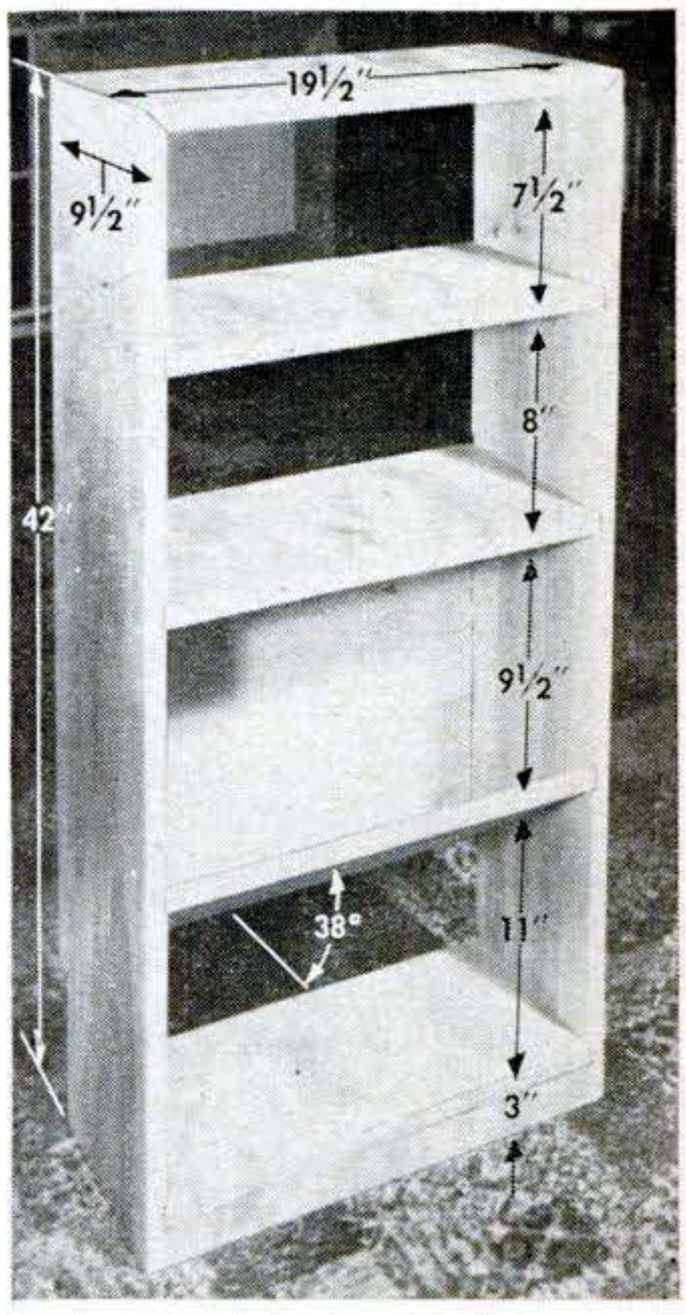
How to Get Plasterboard into Attic

It's sometimes impossible to get large plasterboard sheets up the stairway and into the attic. I solved this problem by scoring the board lengthwise, down the middle of the back, and folding it in half. When it was in the attic, I unfolded the board and sealed the break in the back with cloth tape. The front surface remained unbroken and the irregularities of the crack were easily smoothed back into place.—*Dale C. Reed, Arlington, Va.*



Bookcase Has Special Shelf for Newspapers

If you like to keep old newspapers handy, a bookcase with one shelf slanted at a 38° angle will hold them neatly. This one was constructed of 1″ by 10″ boards, with the shelves dadoed slightly into the sides, and the top mitered to the sides. The parts were glued and screwed together and the screws hidden with wooden plugs, cut with a plug cutter. Nails and plastic composition wood would also do. If the case is not backed completely, nail a backboard behind the slanted shelf to keep papers in place. —*Willard Allphin, Danvers, Mass.*



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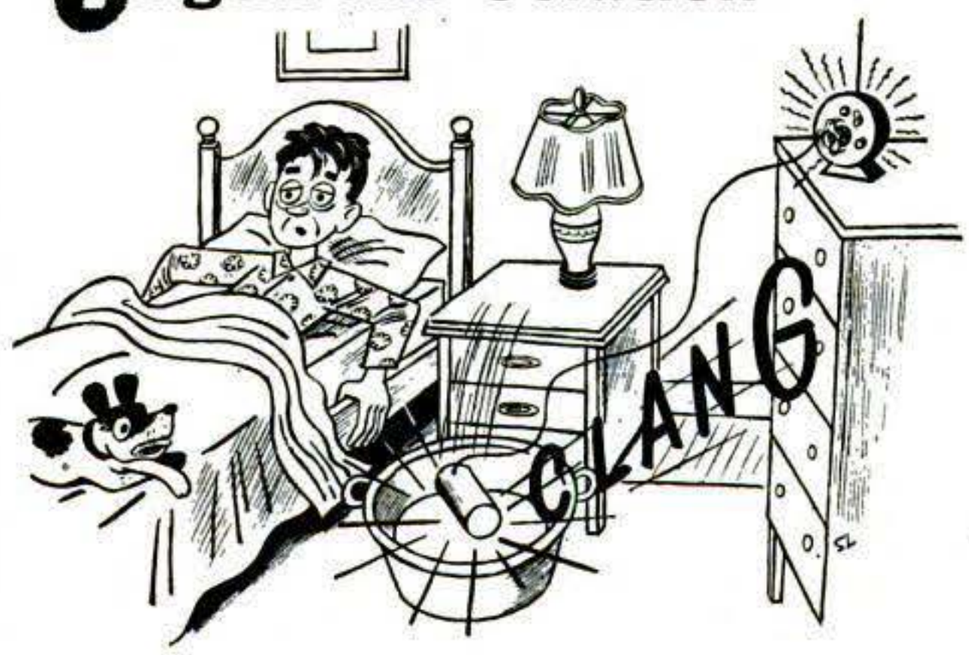
Phono Record Calls Radio Hams

When a radio amateur wants to talk to anyone who happens to hear him, he broadcasts a "CQ" or general-inquiry call in which he repeats his own call letters several times and tells what frequencies he will be listening on for a reply. If he gets no answer, he repeats the whole business. Paul Ford, W9KOJ, of Terre Haute, Ind., saves his voice by using a recorded CQ for each band he works. The record does the repeating until he gets an answer. Then he switches to a microphone and takes up from there.

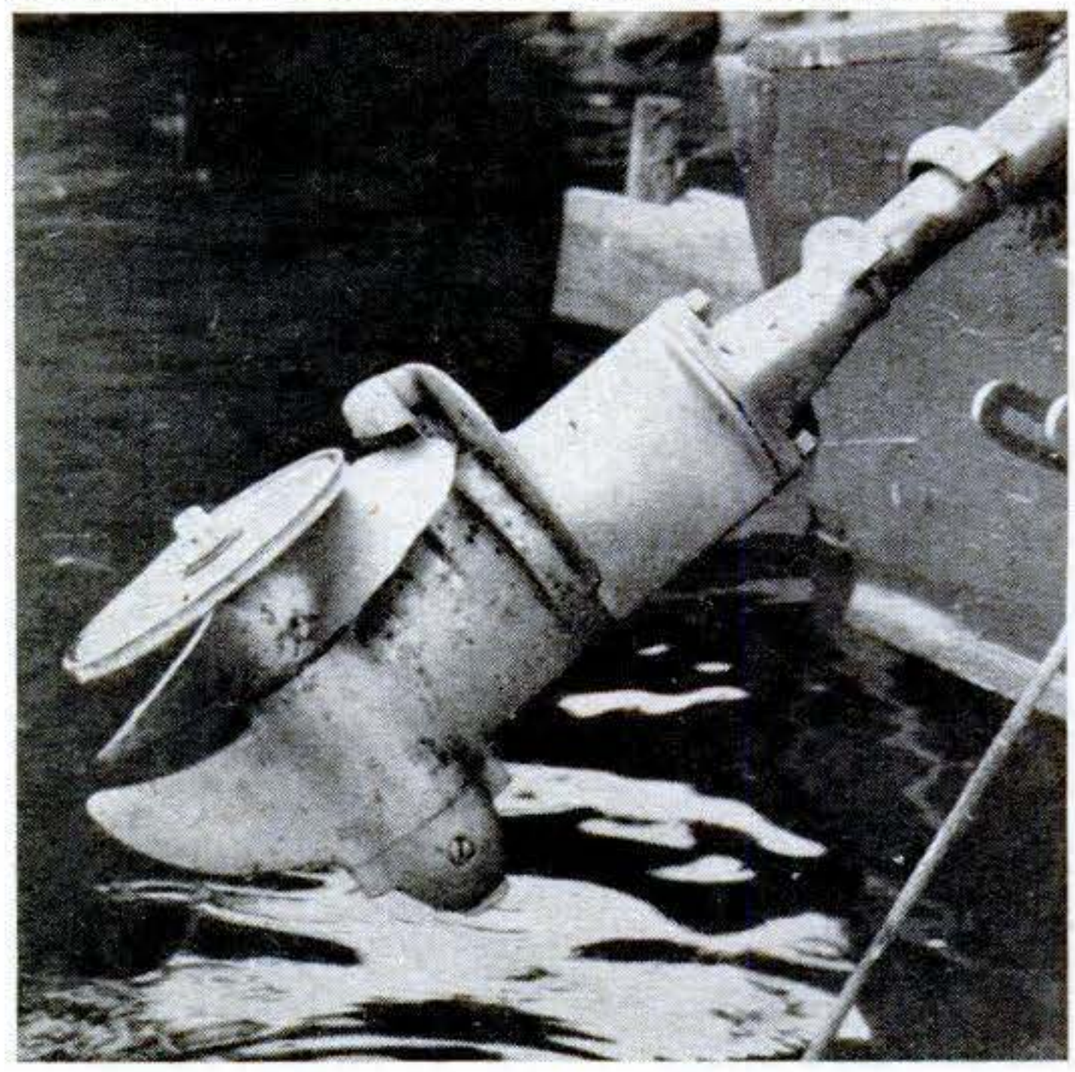
My Most Ingenious Solution



The alarm clock never rouses me. When my wife was away for a few days on a visit, I was faced with the problem of waking in time to go to work. How do you think I solved the problem?

I placed the alarm clock on the dresser and an empty can on the night table. I tied a string from the clock's winding handle to the can. When the alarm went off, it wound up the string and pulled the can off the table. On the floor by the table, I had a dishpan. When the empty can crashed into the dishpan, I woke up—fast.—Neil Creighton, Clearwater Lake, Wis.

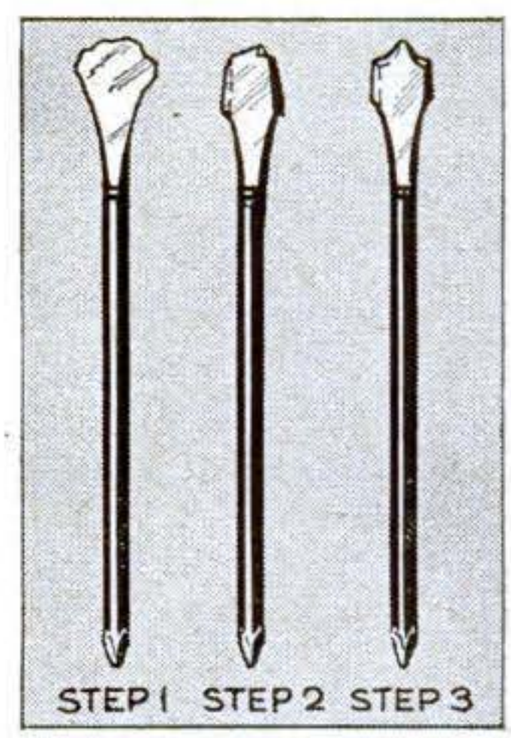
Paint-Can Lid Makes Trolling Plate



If you like to troll for fish but your outboard motor won't slow down enough, you need a trolling plate. You can make one by attaching the lid of a gallon paint can to the propeller shaft. Punch a hole in the lid's center to fit the shaft.—*John R. Perkins, Wayne, Maine.*

Emergency Drills Made from Nails

Because students were breaking small drills faster than they could be replaced, Lloyd Heberle, school shop instructor at Townsend, Mont., now makes wood drills from nails. These are good enough for rough work while students are learning. He flattens the head and grinds two cutting edges on opposite sides. Then he grinds a point and a cutting edge on each side. The steps are shown at right.—*E. V. Reyner, Townsend, Mont.*



Plastic "Tile" Can Be Brushed On

You can now buy "tile" in cans. Called Fluid Tile, the plastic can be brushed or sprayed over plaster, wood, concrete, metal, or linoleum. It drys fast, shows no brush marks, and is resistant to water, soap, oil, acid, alcohol, and heat. Cost is less than three cents a square foot. On uneven, porous, and heavy-duty surfaces, such as floors, a base coat is brushed on first. The maker is Pavinoleum, Inc., New York City.

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Painting a Ceiling

...It's Easier Now

Paint rollers avert drips, laps, brush marks, and aching muscles. Here's what you should know about them.

By Bernard Gladstone

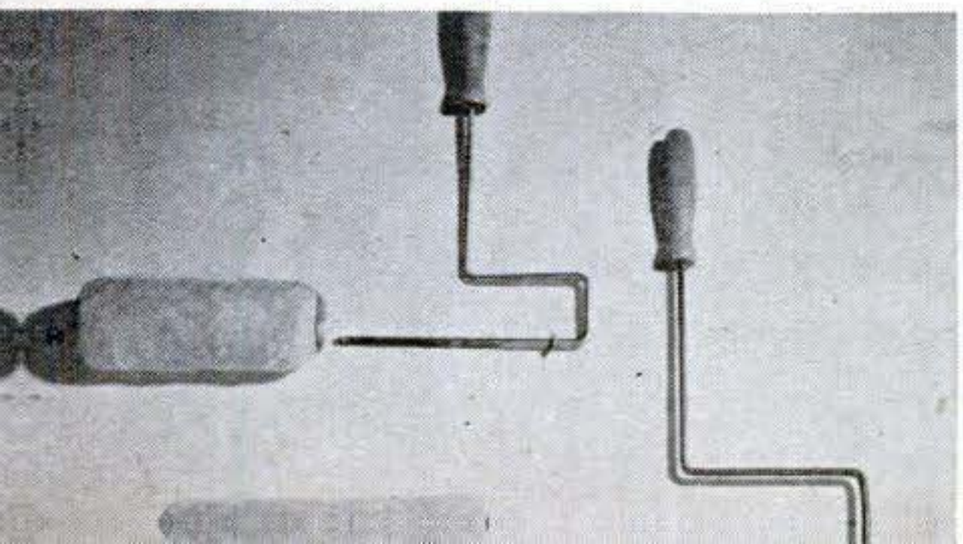
PS PHOTOS BY W. W. MORRIS

PAINTING walls and ceilings used to be a big job. But not any more. With one of the inexpensive rollers available today you can speed through the job easier and at least twice as fast as you could with a brush.

Here are some other advantages:

3 KINDS OF ROLLERS

Pan-type rollers. Both of these rollers are rolled in paint to load them. Lower one has lamb's-wool cover on metal screen. This fits over slotted metal cylinder that is attached to handle. Entire roller of top one slips off handle.



Magazine-type roller. Paint is stored inside hollow cylinder and is fed to working surface through perforations in cylinder. Cover consists of heavy wool sleeves and thin cotton sleeves that are slipped over the cylinder.

Pressure-type roller. Air pressure in a tank forces paint through hose and into hollow axle of roller when valve button is pressed. Perforations in axle let paint into inside of roller. This one has lamb's-wool cover like pan-type rollers.

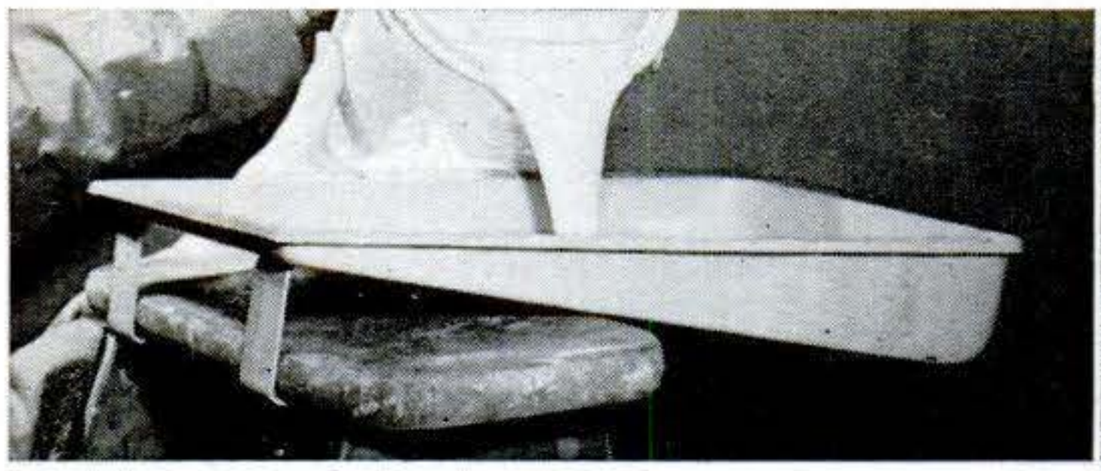
Drips, laps, and brush marks no longer bother you.

Rolling paint on doesn't tire your arms and hands like a brush does. This is especially true of ceiling painting.

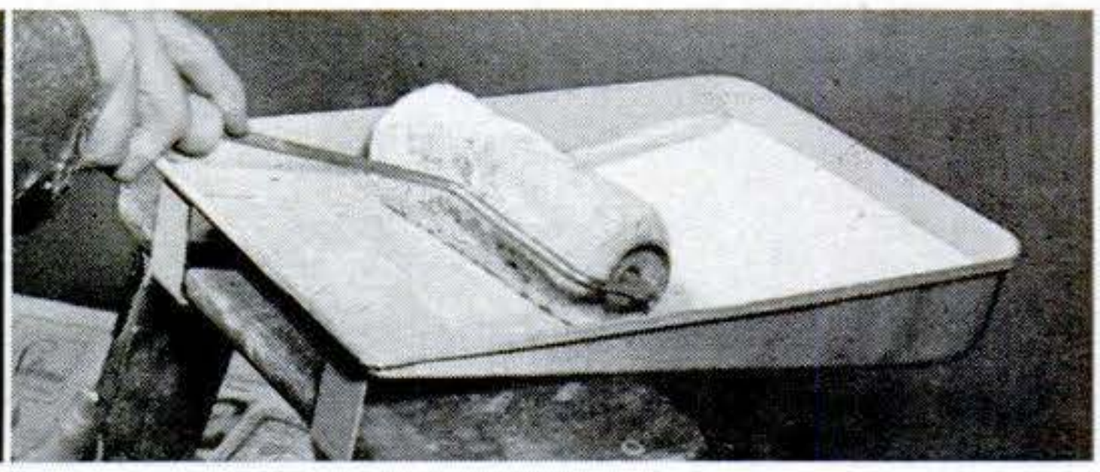
Very often a wall that would need two coats with a brush can be done in one coat with a roller. That's because the roller does an exceptionally smooth job. And you save money before you even start to paint. A roller costs much less than a 4″ or 5″ pure-bristle wall brush.

Paints you can use. Rollers work best with flat or semi-gloss oil paints, water paints, and free-flowing enamels. They are not so effective with varnish or high-gloss

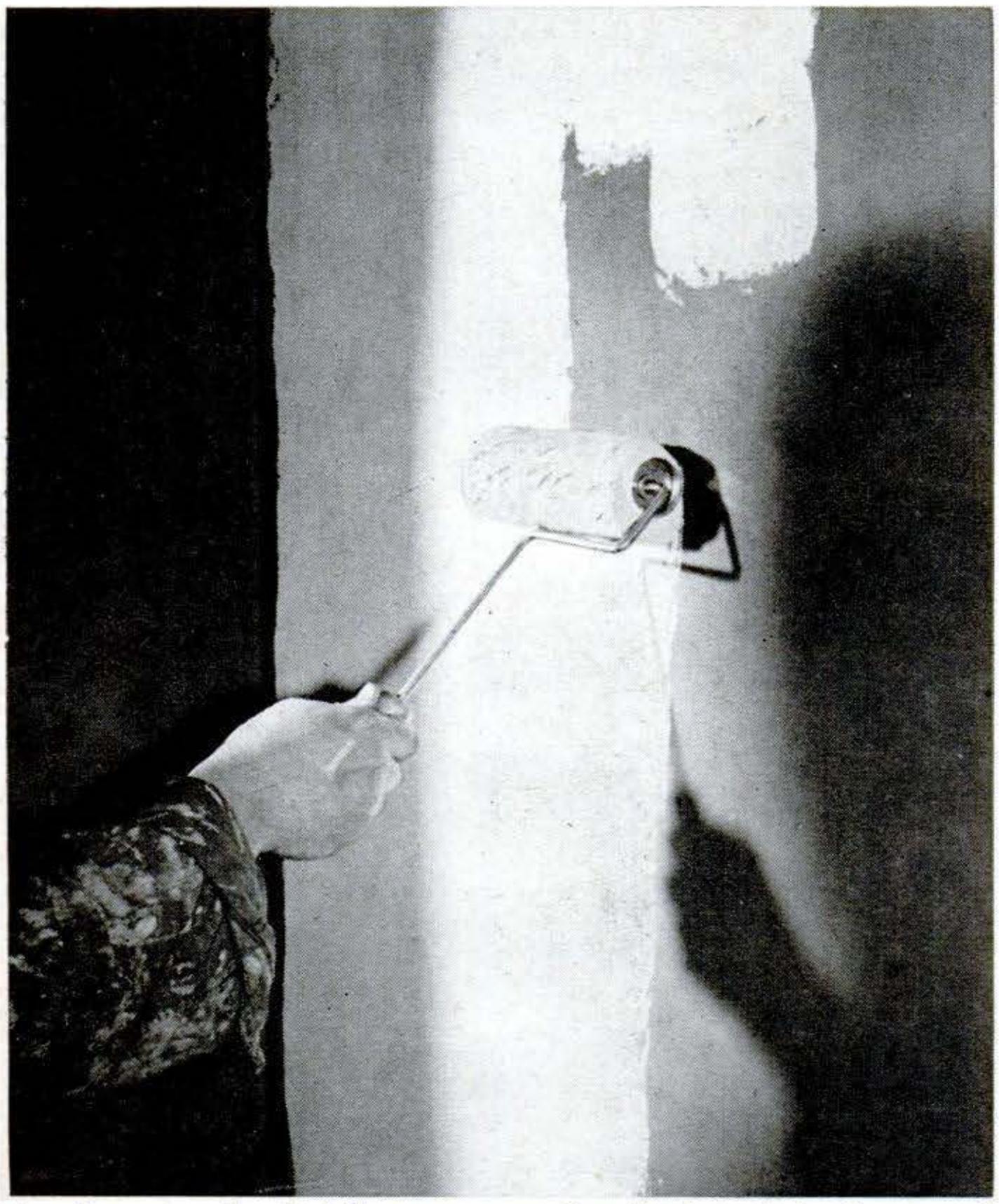
USING A PAN ROLLER



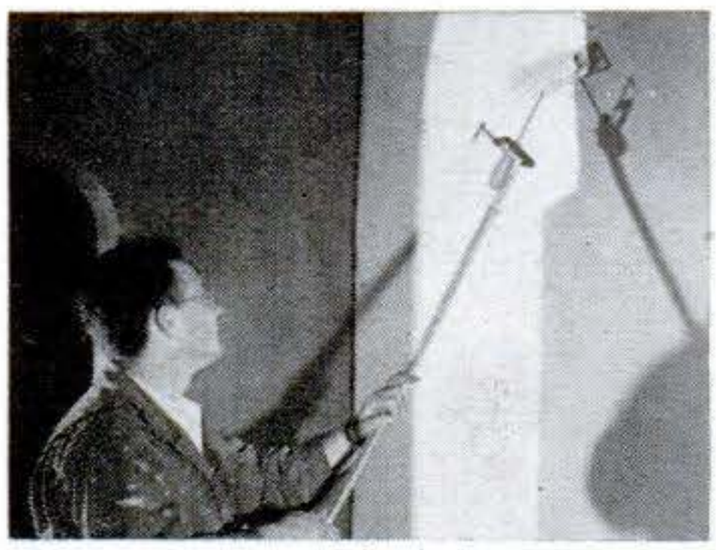
Hook legs of pan on ladder before pouring in paint. You can save yourself a little clean-up work by lining pan with a layer of wrapping paper. Then when you are finished painting you just lift out liner to clean pan.



Start at high part of pan and roll the roller into paint for a few inches. Then roll it a few times on part of pan not covered by paint. Repeat rolling in and out of paint until paint is evenly distributed on lamb's-wool cover.



Apply paint by lightly running roller back and forth. Avoid skips. Don't spin the roller at the end of a stroke. Spinning will cause the roller to throw off fine drops of paint. Same painting technique is used with a magazine-type roller.



Paint walls from top to bottom, working only a narrow strip at a time. For ceilings and upper part of walls—if you don't want to use a ladder—clamp an extension to handle of roller. Cut a flat on roller handle to take a small C clamp.

Cut in edges of ceilings, corners, and around woodwork with a 1½″ or 2″ brush (below). Do this as you go along, not after rolled-on paint has dried. Reason for brush is that it's difficult to get neatly into corners and tight spots with a roller.

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enamels because rollers won't give you the glasslike finish those paints are designed to leave. Trim paints can be rolled on, but you'll get smoother results with a brush. Don't use lacquer or shellac with a roller. Their solvents cause the lamb's-wool cover to deteriorate.

Selecting a roller. The easiest way to do this is to read the directions that come with a roller before you buy it. Then you'll know if it's suitable for the kind of paint you want to use. Some manufacturers don't recommend using their rollers with rubber-base or resin-emulsion paints. Other makers say their rollers work equally well with any paint. [*Continued on next page*]

USING A PRESSURE ROLLER

Pour paint that has been thinned to brushing consistency into tank. Don't fill tank more than two-thirds full. This leaves room above paint for air. Then replace top and make sure it is locked securely before beginning to pump.

Pump up tank until safety valve pops. Pressure outfit shown above includes tank, 15′ hose, and roller. It retails for about $25. It is ideal if you plan to do lots of painting. For small jobs, other types of rollers will do.

Prime pressure roller on pad of newspaper before beginning to paint. Roll it back and forth while depressing valve button. Continue until lamb's wool is evenly covered with paint. Spots of paint are just beginning to show through on cover of roller in photo at right.

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Using a roller. Apply paint by working the roller back and forth lightly over the surface. Do not press hard. Roll in crisscross strokes. Use long, easy strokes, and work in whichever direction is most comfortable for you. Check back as you go and run over skips before the paint gets tacky.

If you have to bear down heavily to get good coverage, the chances are that your roller needs more paint or that the paint is too thick. Paint for rolling should be thinned to brushing consistency. Another clue to paint that's too thick is that it will tend to pull up from the surface as the roller passes over.

If the roller squeaks or rolls with difficulty, then the bearings can use a few drops of heavy oil or light grease. Vaseline will do.

Cleaning rollers. This is an important step when you're switching from one color to another or when you have finished a job.

Take the roller apart and clean all parts with thinner if you've been using oil paint, or with water if it was water-base paint. Wipe the metal parts clean, and clean the lamb's wool by working it in the thinner with your hands.

Pressure-type rollers are a little more complicated to clean because of the tank. First release the pressure by unscrewing the pump handle. Then drain the paint from the hose back into the tank and pour the paint out of the tank. Pour a little thinner in the tank and stir it to dissolve as much paint as possible. Pour this out. Put a half gallon of thinner in the tank and pump up pressure. Hold the roller head in a bucket and depress the valve button until all thinner has run through. Disconnect the hose and coil it up.

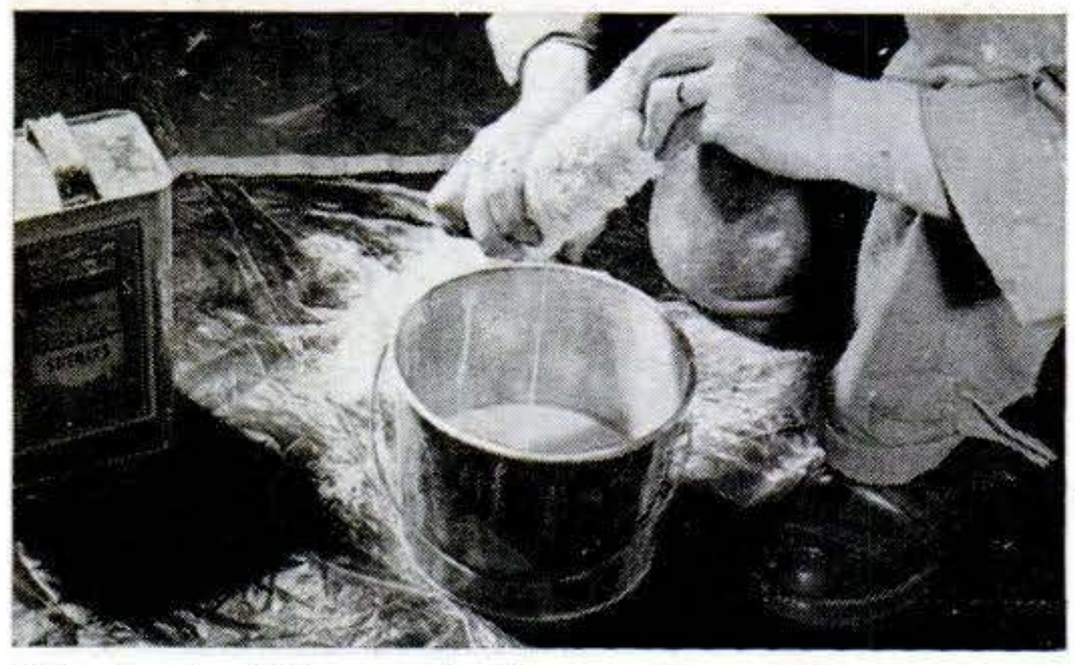
Finally, clean the lamb's-wool cover the same way you cleaned the other covers.

For scores of good ideas on hanging up your tools efficiently, see next month's PS.

CLEANING A PRESSURE ROLLER

Begin cleaning pressure roller by unscrewing pump handle—not the top of the tank—to release pressure in tank. Remove lamb's-wool cover. Then hold handle and hose up and depress valve button to drain paint back into tank.

Clean as much paint as possible off roller by running it back and forth over old newspaper. You may have to use several sheets of paper. Then remove the lamb's-wool cover, or the entire roller if the cover is non-removable.



Wash lamb's wool thoroughly. If you were using oil paint, wash in mineral spirits or turpentine. For water paint, wash roller in water. Never use lacquer thinner or alcohol. These will cause the lamb's wool to deteriorate rapidly.

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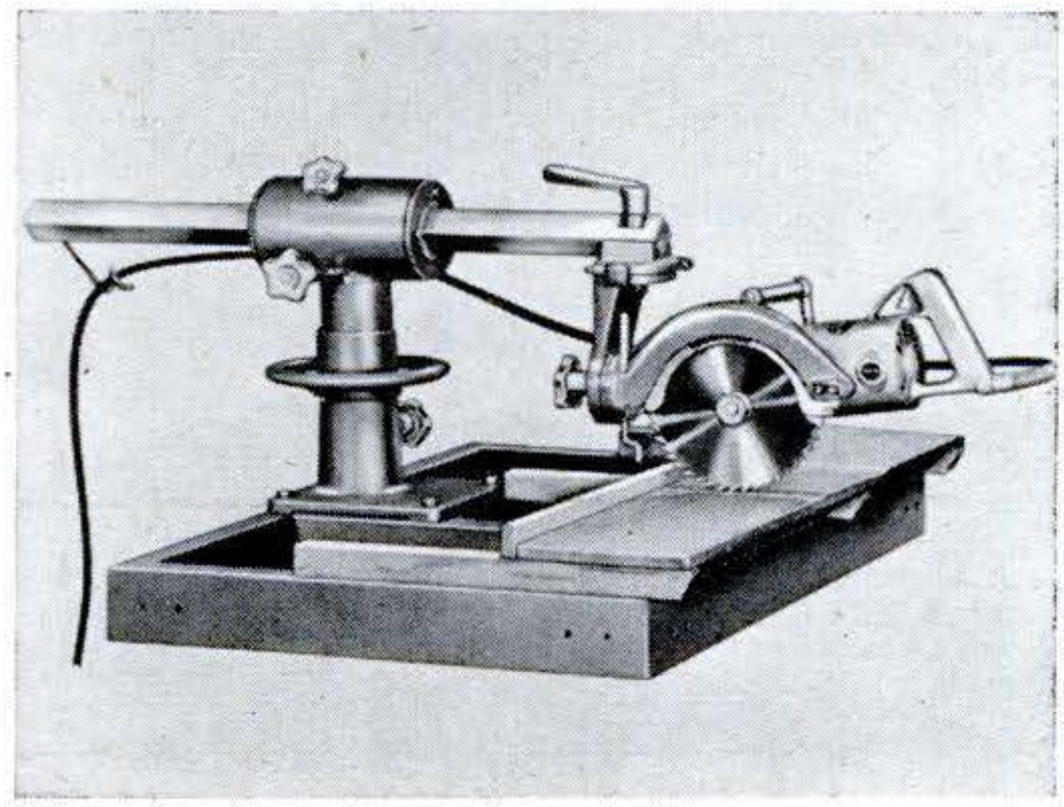
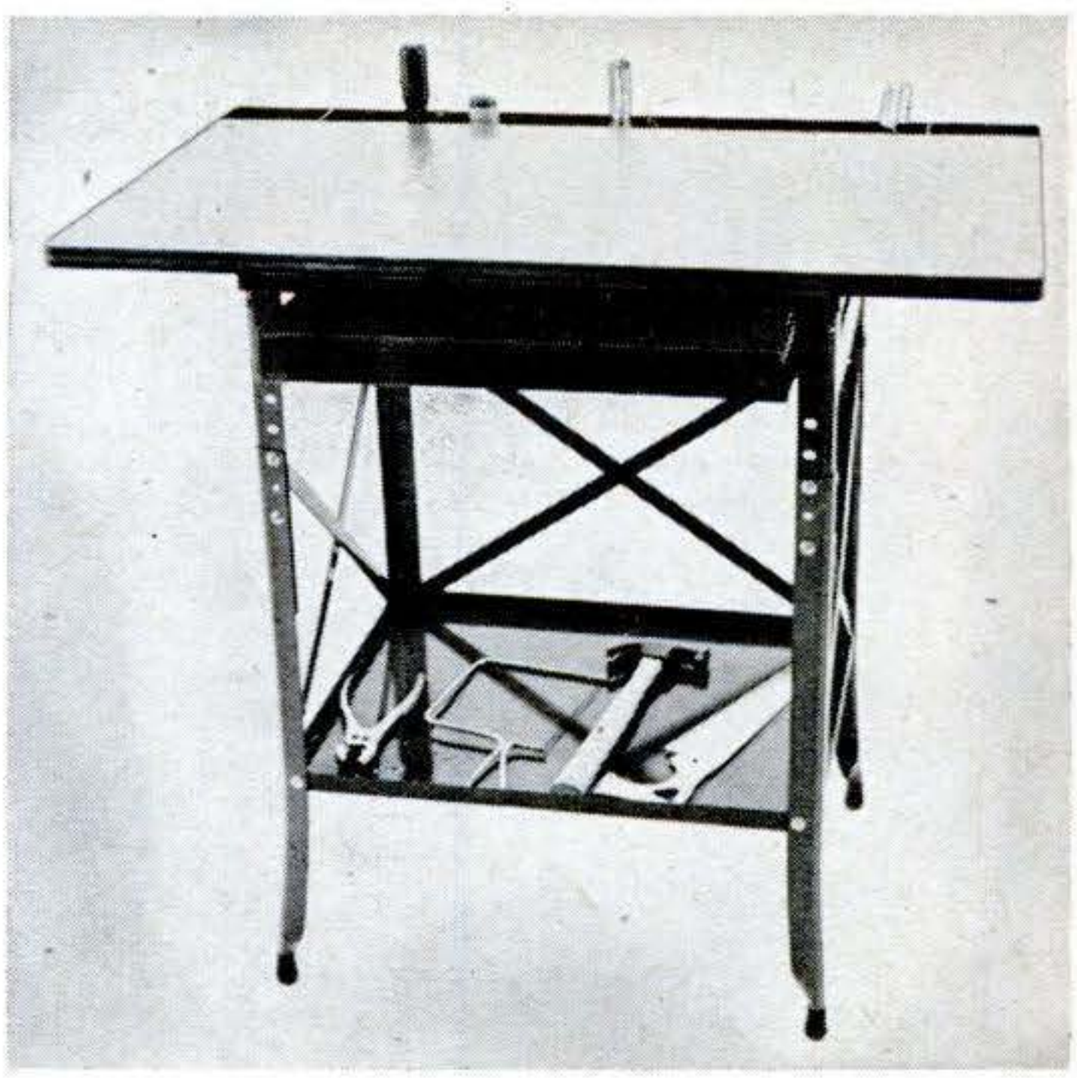
New Tools



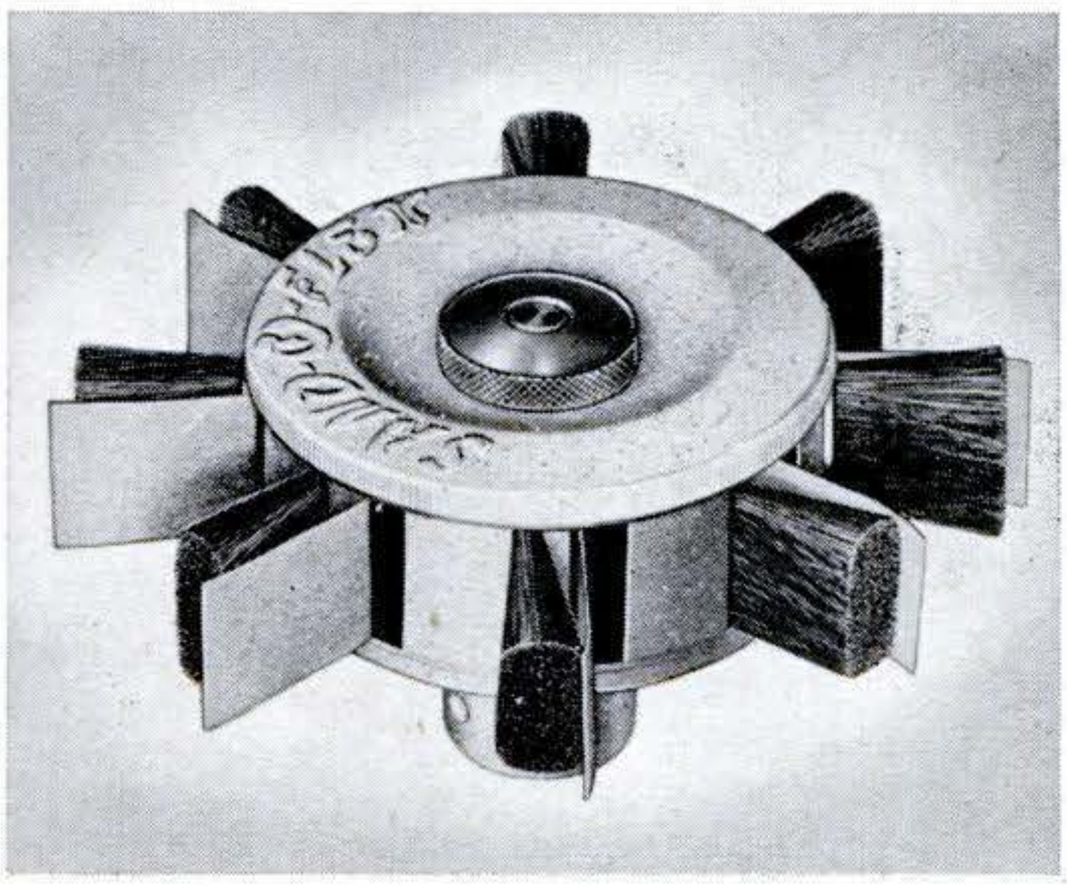
Portable Saw Becomes Radial Saw. You can convert one make of power hand saw into a radial saw with this metal stand. Made by Skilsaw, Inc., of Chicago, for Skil Saw models 77, 87, 800, and 825, it bevels, miters, dadoes, and ploughs on an 8½″ by 40″ work table. The supporting arm can extend 22½″ horizontally and shift 6½″ vertically. Angle cuts 45° left or right are possible.

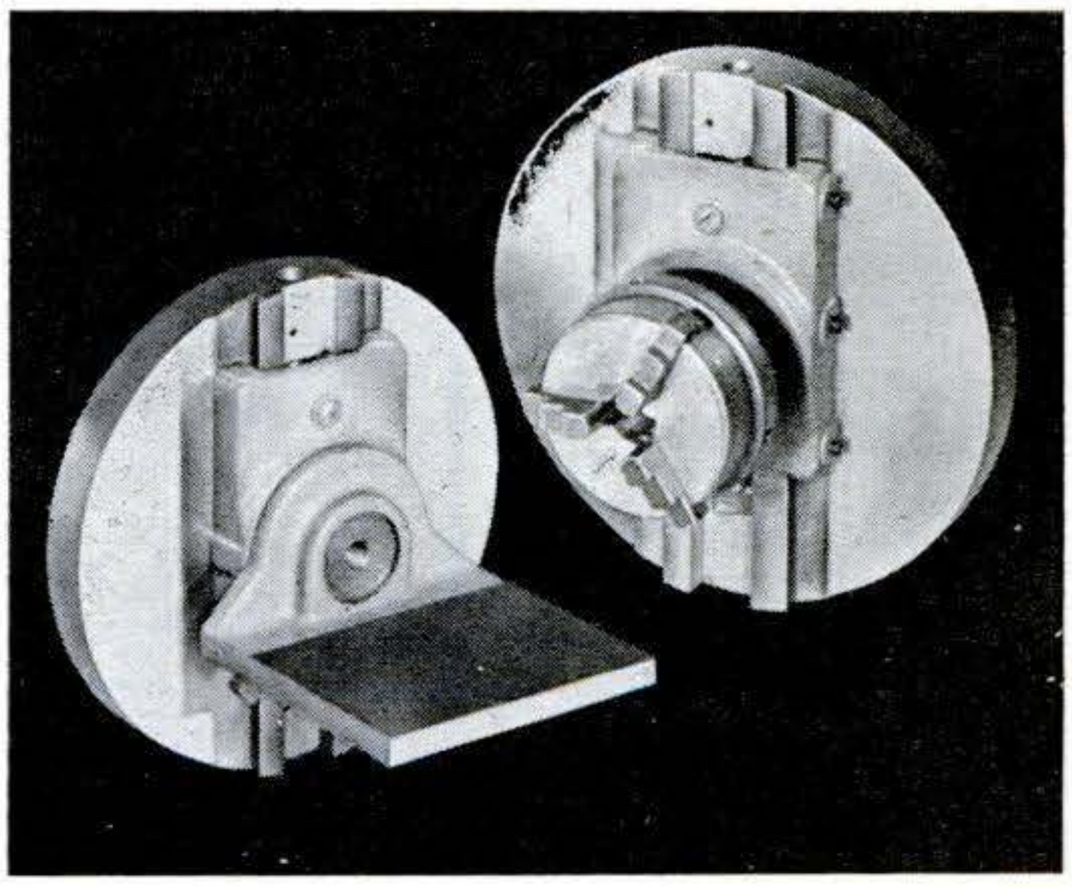
Sand Curves With a Drill. A new contour sander is designed especially for attachment to portable power drills and flexible shafts. It finishes curved surfaces by spinning eight pieces of 1″ abrasive cloth that are backed by replaceable brushes. As the wheel rotates, the cloths mold themselves to the contour of the work with a paint-brush action. Worn abrasive is cut off and replaced with new strips pulled out from a central magazine. The 1¾-lb. tool is priced at $12 by the manufacturer, Merit Products, Inc., of Culver City, Calif.



Workbench Height Is Adjustable. This bench has a ¾″ plywood top, 16″ by 22″, with a drawer underneath. Its height is adjustable from 25″ to 30″ to suit the user. It is priced at about $12 by Lenox Metal Manufacturing Co., Maspeth, N. Y.

Faceplate Has Adjustable Slide. This new faceplate for small lathes is fitted with a dovetailed slide on its diameter, and a boss that can be locked anywhere along the slide. On the boss you can mount a small chuck, an angle plate, or other fixture. By moving the slide and rotating the fixture on a boss, any point on the work can be brought to lathe-center height. This combination can also be set up as a boring mill: the boring bar is chucked and the work secured to the angle plate mounted on the compound. The 8″ faceplate is threaded for a 1½″-8 lathe spindle, and the complete outfit is sold for about $56 by Micro Lathe Plate, Inc., Cleveland.





Turn the page, please, for more new tools.

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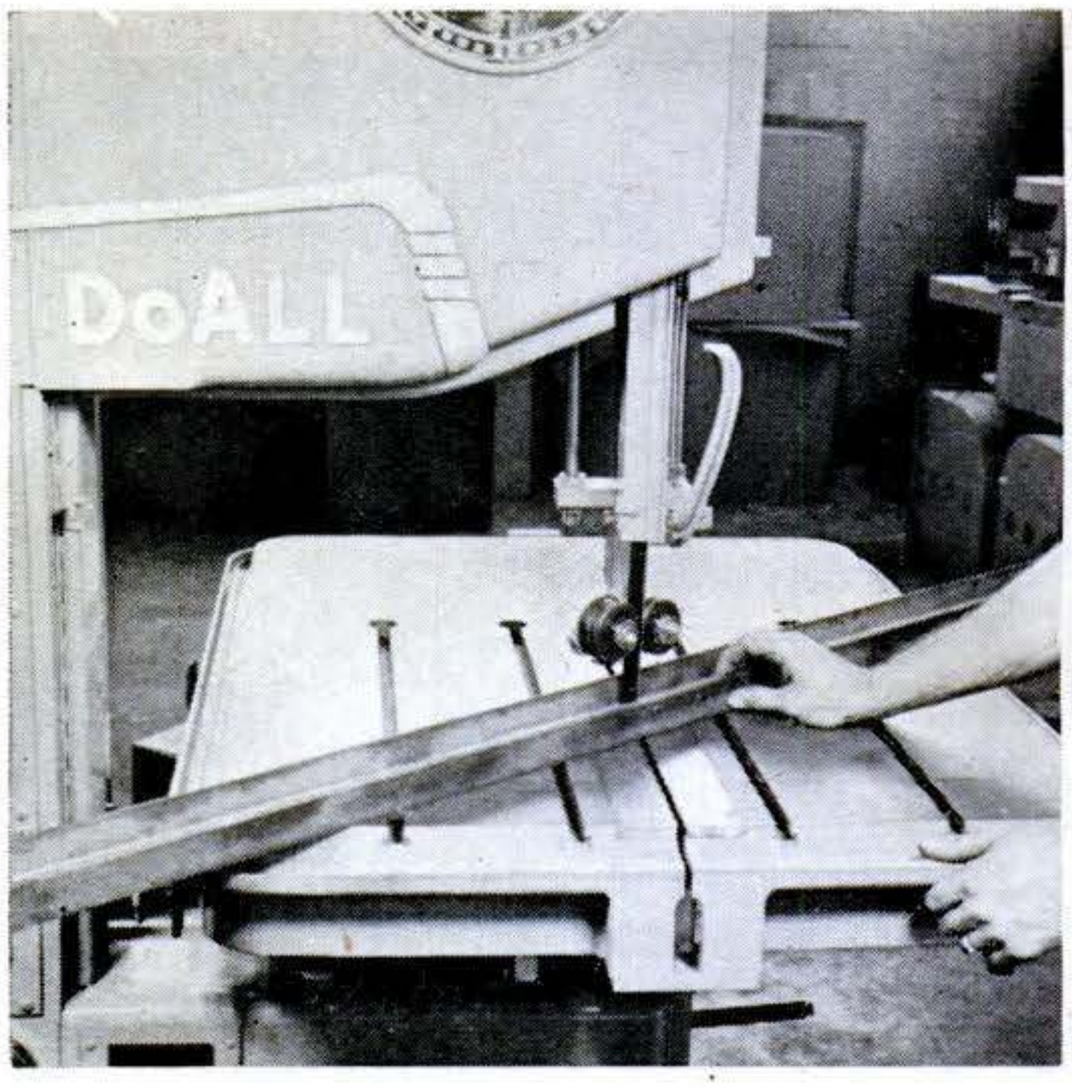
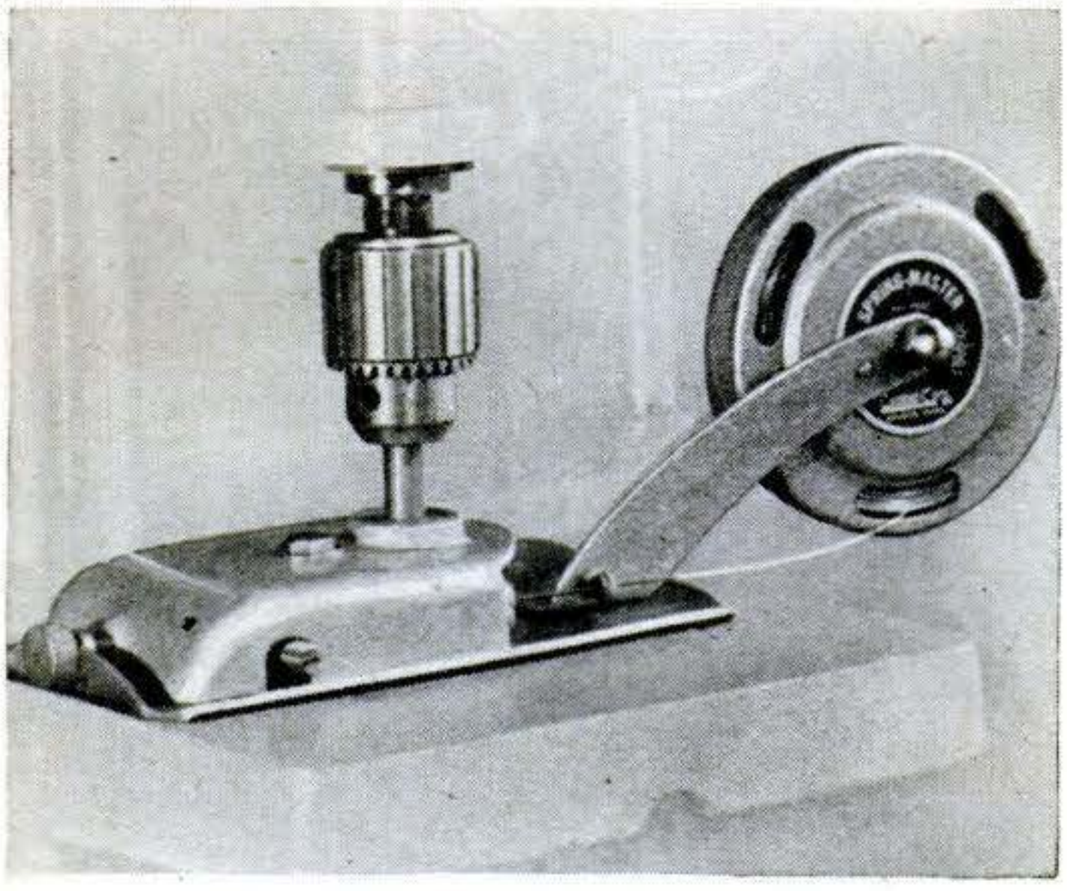
Calculator Answers Craft Questions. By turning the dials of this calculator, you can find the data you need on lumber, nails, drill sizes for screws, concrete mixes, paints, and tool sharpening. Characteristics of 33 woods are given, showing tendencies to swell or shrink, comparative weights, hardness, and degree of workability with hand tools. The calculator is sold by Greenlee Tool Co., of Rockford, Ill.

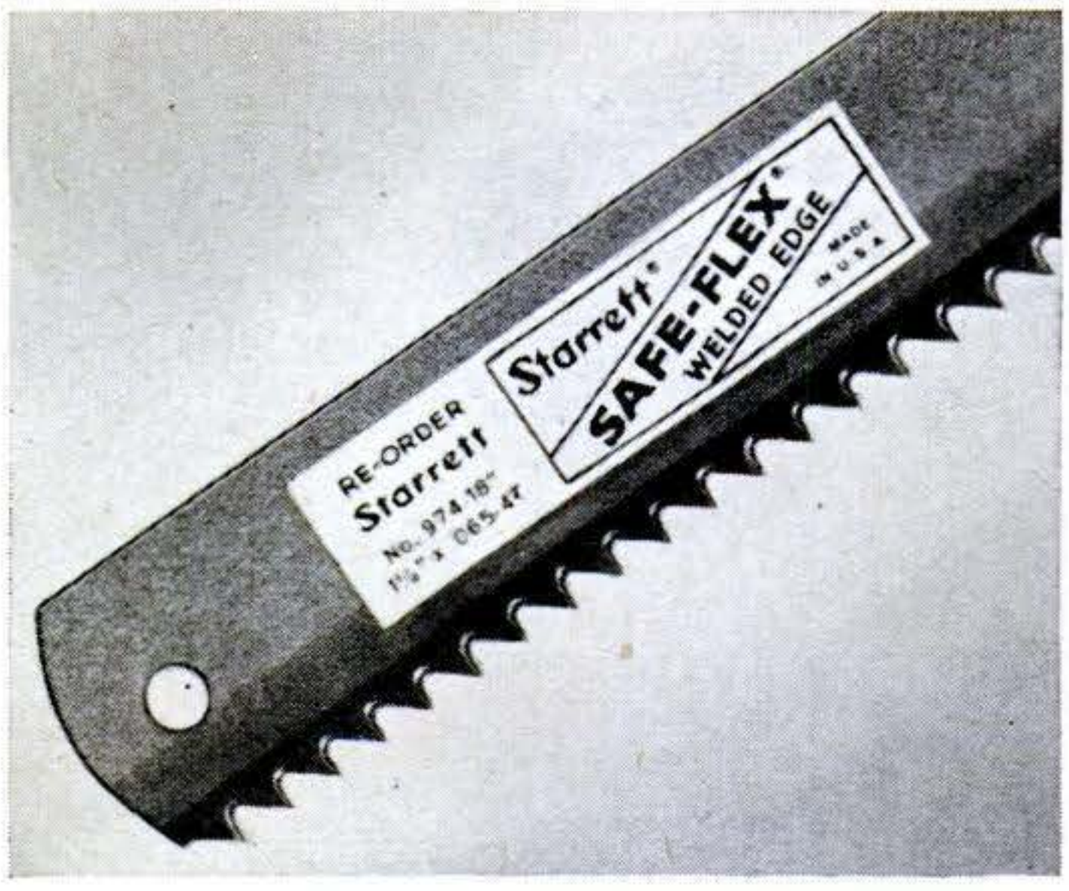
Make Springs on Your Drill Press. A drill press becomes a spring-making factory with this attachment. The spindle of the drill winds the wire into a spring that is fed out through the slot in the drill-press table. Wire from 8 gauge to 28 gauge can be used to make springs 3/16″ to ⅝″ in diameter and of any length. Raising or lowering the spindle controls the pitch of the spring coils. The manufacturer, the Cycloid Corp., Saugus, Mass., prices the Spring-Master at $65.



Bandsaw Throat Capacity Increased. There's no limit to the length of stock you can cut off square on a bandsaw with these angle saw guides. The guides twist the saw band so it is at a 30° angle to one side of the table. Work of any length then can be fed into the blade without striking the frame. The diameter or width of the stock that can be cut off at this angle depends, of course, on the throat capacity of the machine. The DoAll Co., Des Plaines, Ill., makes the guide for all models of its bandsaws.

Three-Part Hacksaw Blade Is Welded. The three types of steel welded together to form this power hacksaw blade are said to make the blade shatterproof and virtually unbreakable. A high-speed steel cutting edge is welded to a center that is in turn welded to the back. Blades are made in three sizes—4, 6, and 10 teeth per inch—by the L. S. Starrett Co., Athol, Mass.





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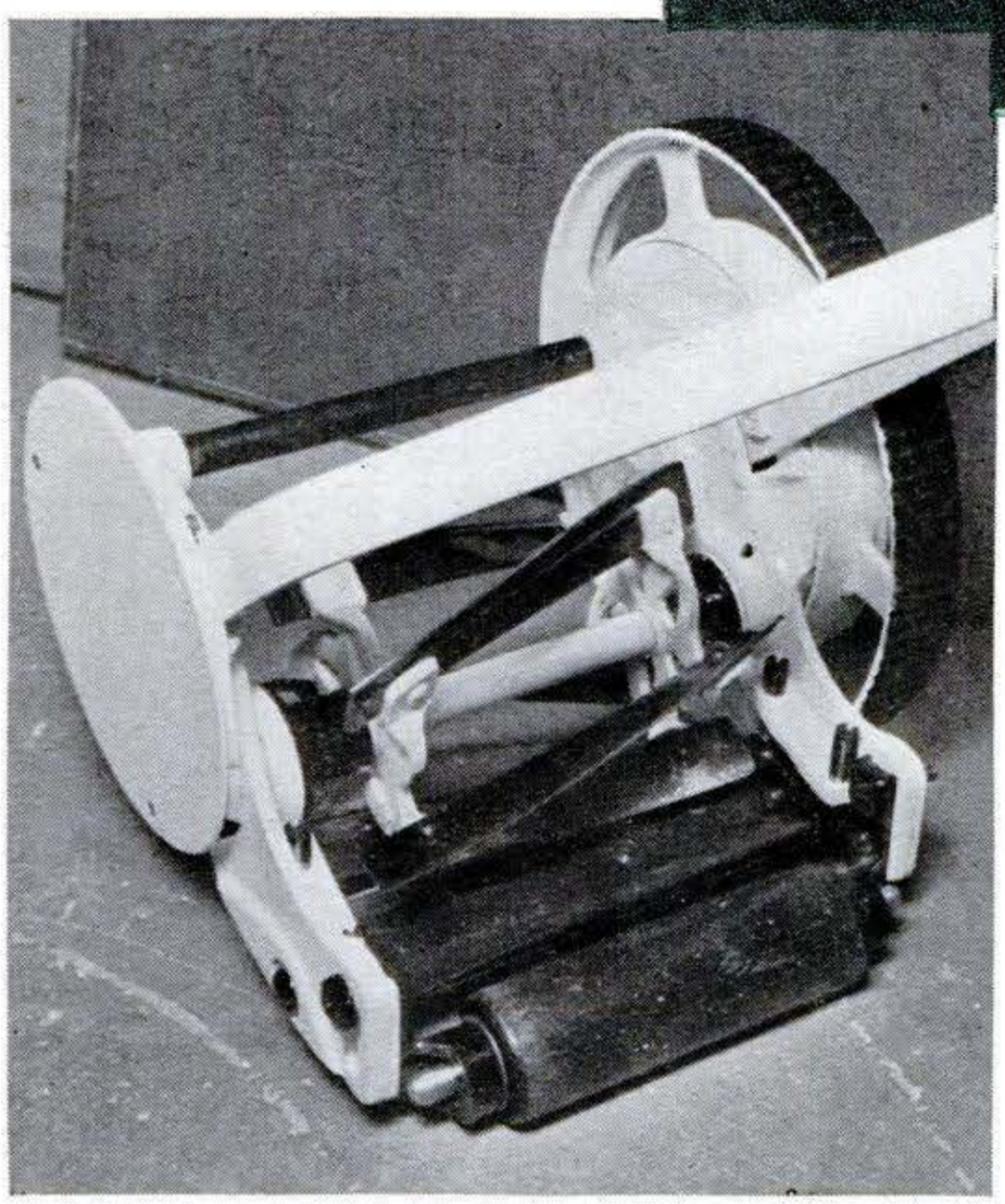
Narrow Mower Trims the Edges

Saw down an old one to one-wheel size and your yard work will be a lot easier. Here's how one man did it.

Cutting along edge of cultivated area is easy, for roller supports most of the weight of mower. An aluminum disk was mounted on non-drive end as below. Lack of wheel at this end lets you cut closer to wall or fence.



DO YOU have a lawn mower that's just about on its last legs? Or a rusty old one stored away in the garage?

If so, you have the basis of a very handy lawn edger. With it, you'll be able to cut close to borders, slip into spots that are too narrow for the regular mower, and trim along flower beds without balancing one wheel in midair.

Clean it up first, washing off oil and grease with gasoline. Then, if possible, have old paint and rust sand-blasted off. Stone-cutting yards will often do this for you if you give them degreased parts.

A mower with four spiders holding the blades is preferable because you can then cut off a two-spider reel. Before you start cutting, check the wheel bearings to see if there's a choice between them. Use the end

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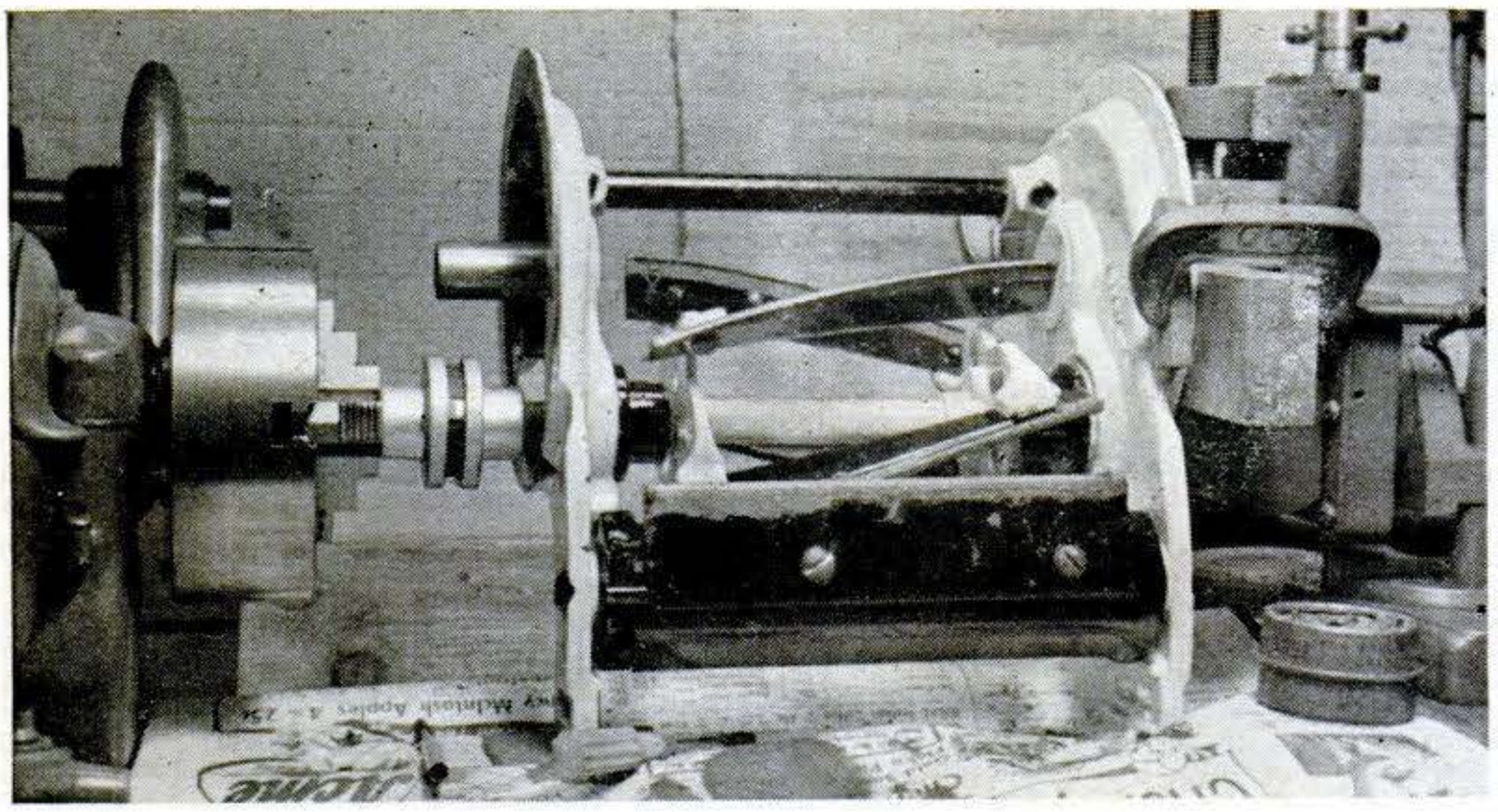


Grinding reel against stationary blade gives best results. Here's how it can be done in a lathe. Milling attachment supports mower frame at one end, blocks at the other. Flexible coupling drives reel shaft. Brush coarse valve-grinding compound on blades.

of the reel that has the adjustable bearing cone. (This one is threaded on the reel and has a setscrew to hold it firm.) Inspect the driving pawl for excessive wear.

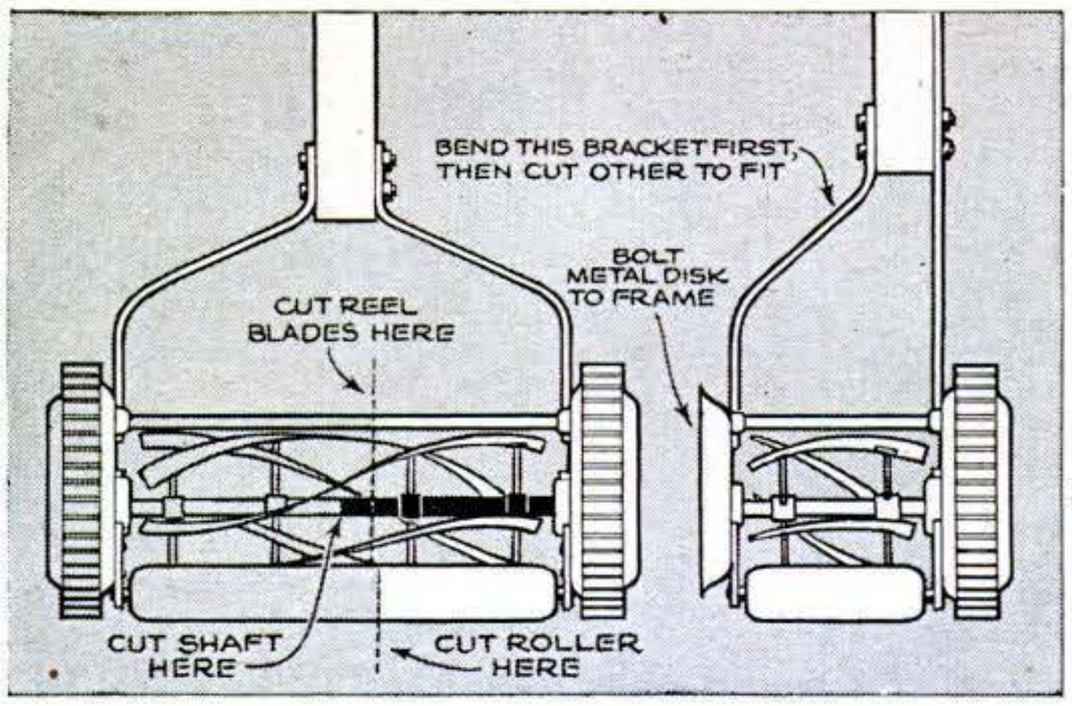
The blades are semi-hardened, but I was able to cut them with a hacksaw. Cut the reel shaft a little longer than the blades. Then temporarily assemble the two side frames, the cut-down reel, and the front bar. This will give you a location for cutting the stationary blade.

This part usually consists of a cast-iron support with a thin steel blade. The support can be hacksawed to length, but you'll probably have to grind a groove in the blade and then break it.

Assembling the blade support may prove tricky. I cut the mounting block from the discarded piece and then bolted it in place on the end of the part I planned to use. It was necessary to file away the top of the support to do this. Keep the blade in its same relative position, or drastic grinding will be needed to sharpen the blades.

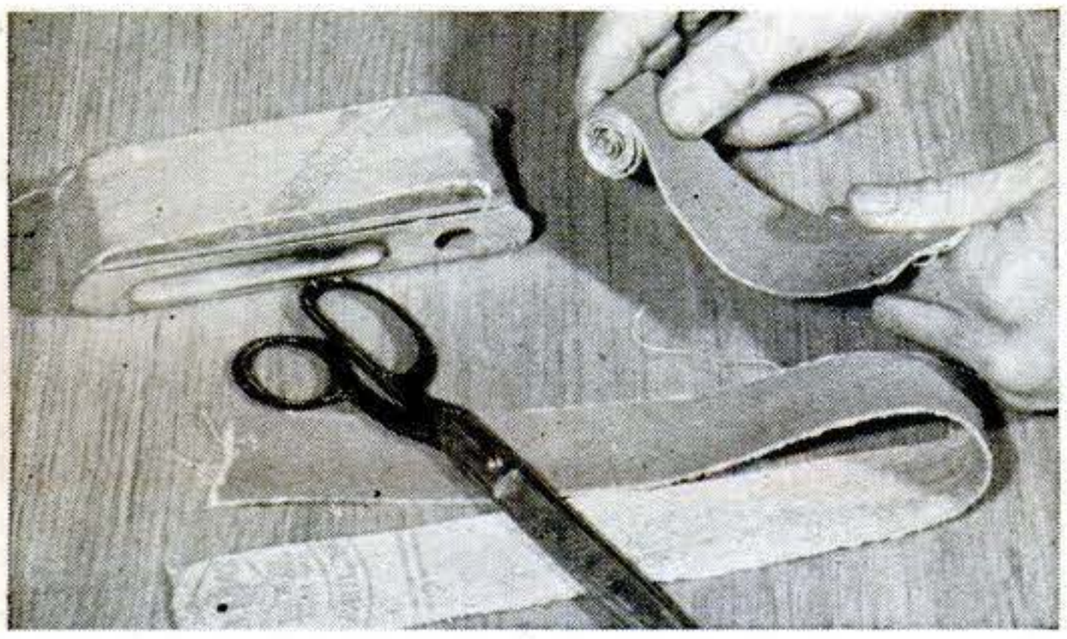
For appearance, an aluminum disk can be placed over the frame casting on the side where you have discarded the wheel. The wood roller must be shortened to fit.—*Howard G. McEntee, Ridgewood, N. J.*

Now you can use radio controls for models without a ham license. See next month's PS.



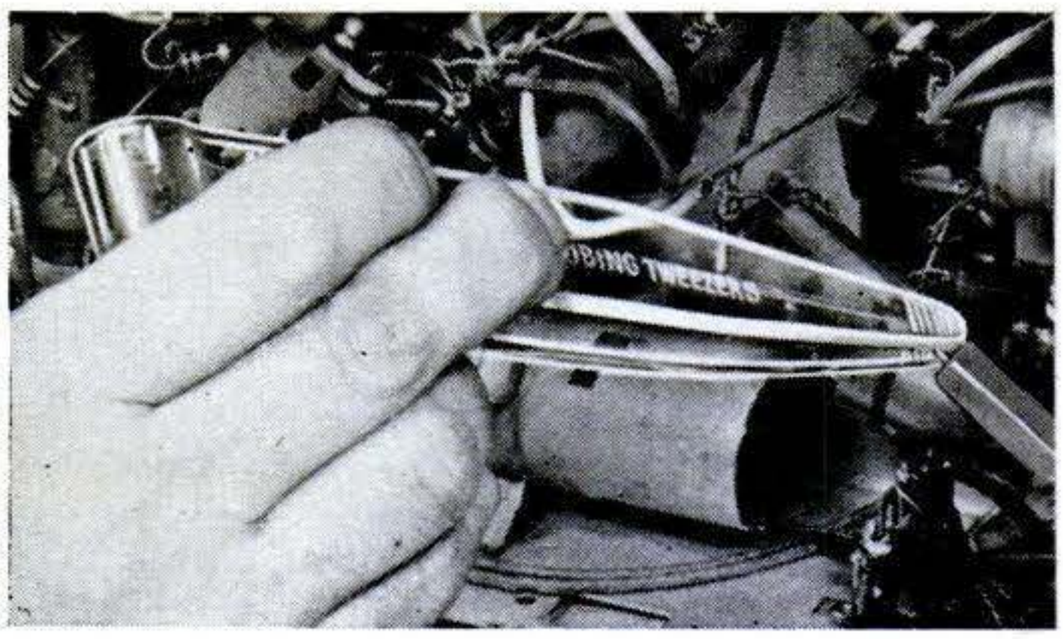
Sander Rolls Cut from Old Belts

IF YOU find that ordinary sandpaper rolls for the type of sander shown in the photo below wear out too quickly, try abrasive cloth. Cut rolls from the discarded belts of power sanders. These still have a lot of life and many cabinet shops throw them away.



Tweezers Make Probing in Sets Safer

TO LOCATE some types of intermittent radio troubles you have to poke around under the chassis while the power is on. The plastic probing tweezers below make the job safer. They're sold for 35 cents through distributors of Hytron radio tubes.



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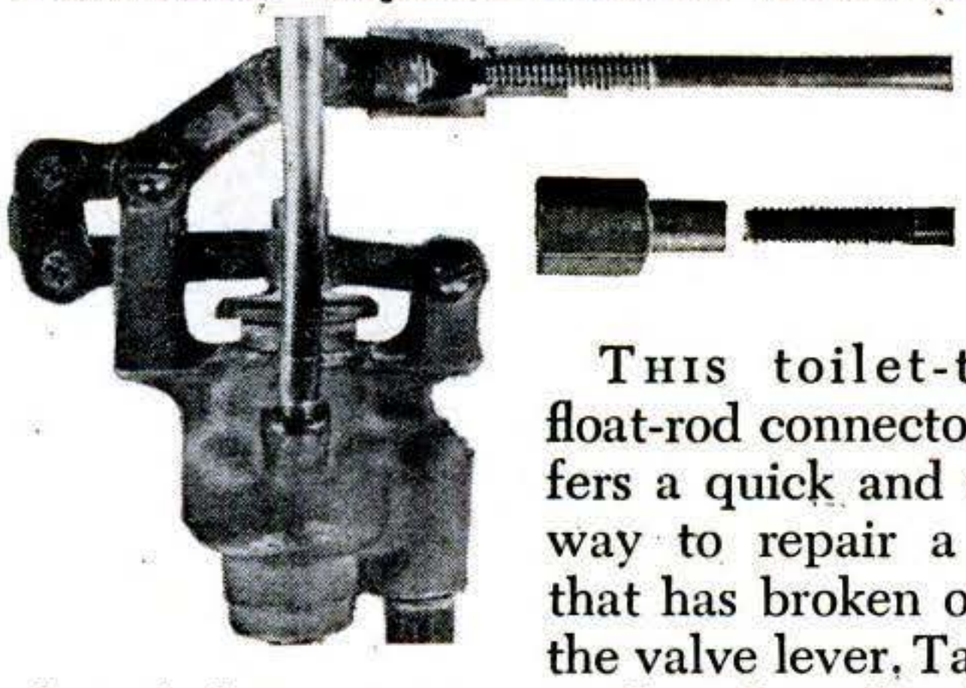
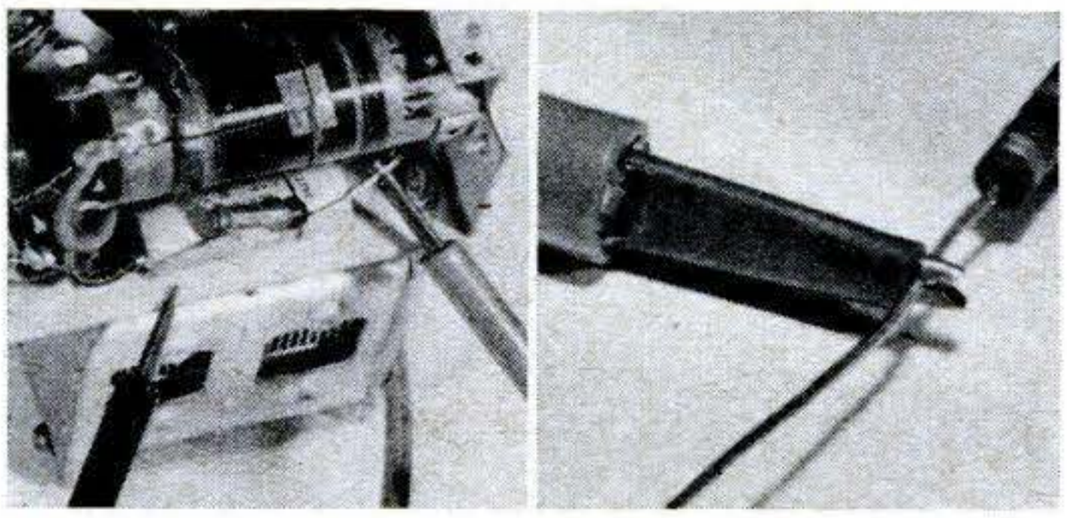
Connector Repairs Broken Float Rod



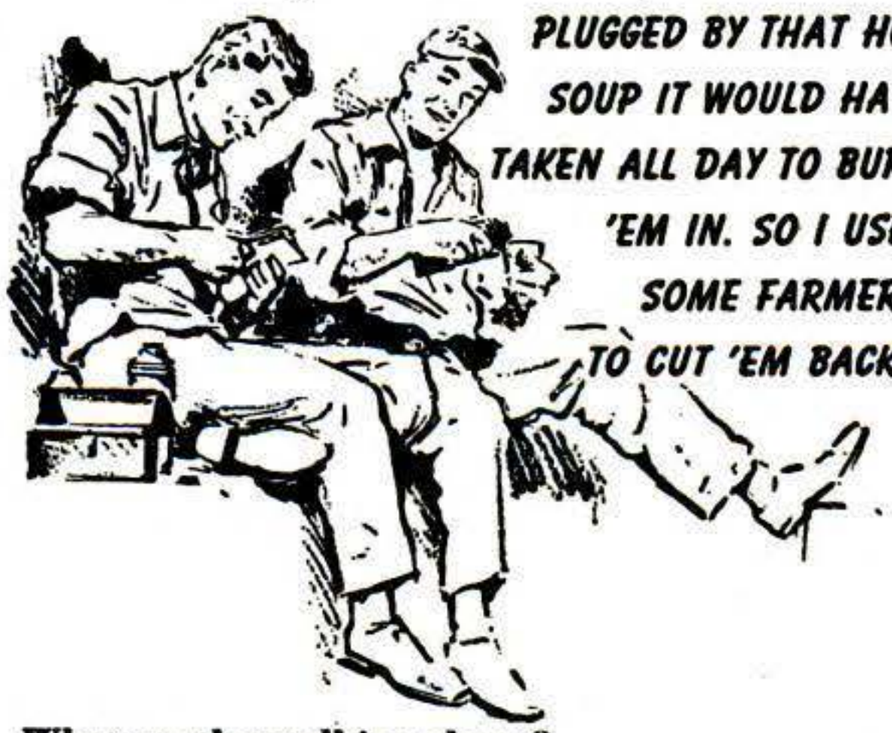
THIS toilet-tank float-rod connector offers a quick and easy way to repair a rod that has broken off in the valve lever. Taper-threaded, it cuts its own thread on the valve lever. The only tool needed is a pair of pliers. Called Fas-Rep, it's made by the Budde Mfg. Co., Omaha, Neb.

Test Prods Have Wire-Gripping Tips



THESE test-prod tips have spring jaws that clip onto wires, chassis, tube pins, or pigtail leads and leave your hands free for servicing. Grip Tip leads are made by the Jiffy Clip Mfg. Co., Huntington, N. Y., and sell for about $1.50 a pair.

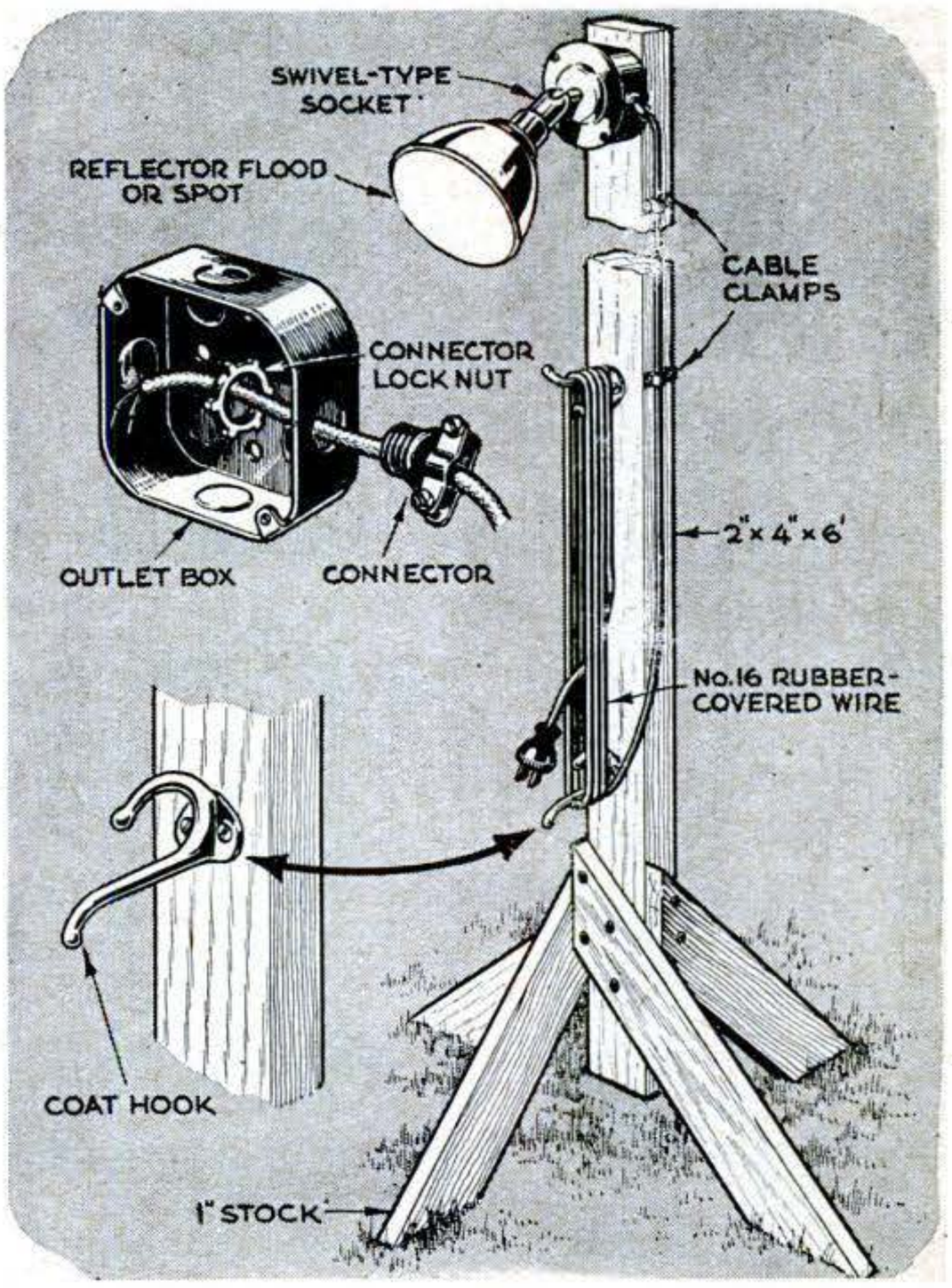
Shoptalk: *"THEY WERE SO PLUGGED BY THAT HOT SOUP IT WOULD HAVE TAKEN ALL DAY TO BURN 'EM IN. SO I USED SOME FARMER'S TO CUT 'EM BACK."*



What are they talking about?
Where do they work? Answer below.

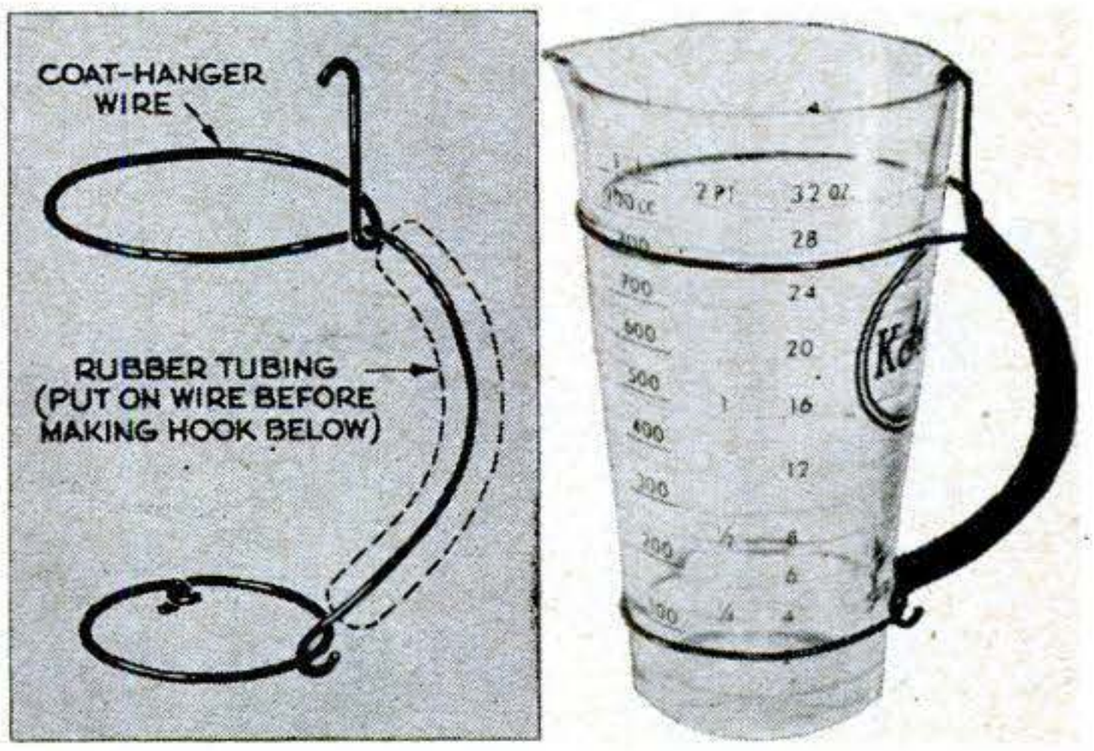
They are photographic darkroom technicians. The temperature of the developer (soup) was too high. Consequently, the negatives were too dense (plugged) to make good prints. To reduce the density, they were treated with a chemical reducer (Farmer's).

Portable Lamp Lights Outdoor Jobs



IF YOU have a lot of outdoor jobs, let this portable light extend your working hours. You can make the stand from scrap lumber. The upright should be 6′ or 8′ high and the feet 15″ or 20″ long. Mount a standard outlet box and swivel socket and connect enough rubber-covered cable to reach a house outlet. Use outdoor fixtures and wire if you plan to leave the stand outside for long periods. When not in use, the wire can be wound around coat hangers or pegs fastened to the upright.

Handle a Graduate with a Handle



A WIRE and tubing handle installed like this will make it easier to manipulate a large glass graduate while pouring photo solutions.—*John J. Rea, Urbana, Ill.*

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Put Up a Sign

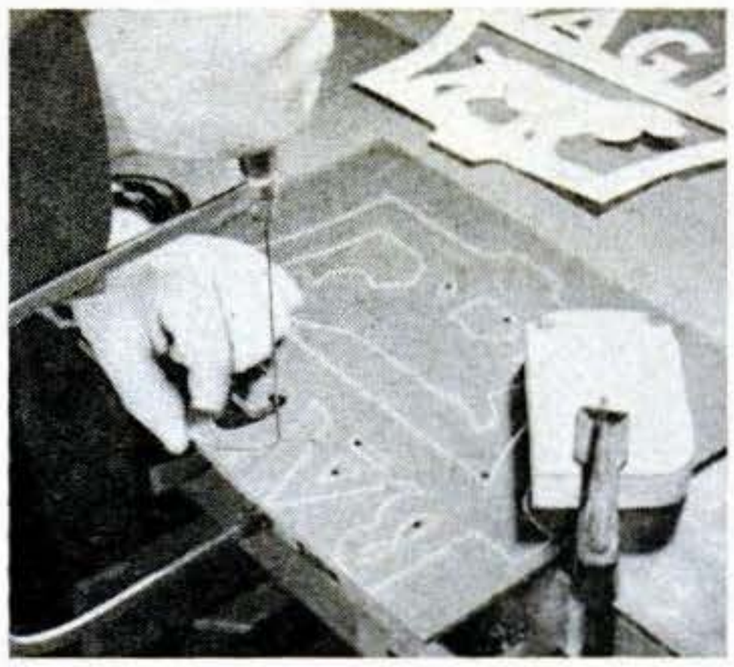
It's a Courtesy You Owe to Others

BESIDES saving other people's time, a house sign spares your own nerves. Dinner guests won't unwittingly drive past, nor will you have to tell deliverymen that the Smythes live next door. And when you call a doctor or a plumber, it's good to know your house can be found quickly.

These examples, designed by a Westport, Conn., artist, show some attractive sign ideas. If you don't have an artistic bent, lettering and silhouette designs can often be found in magazines and newspapers.

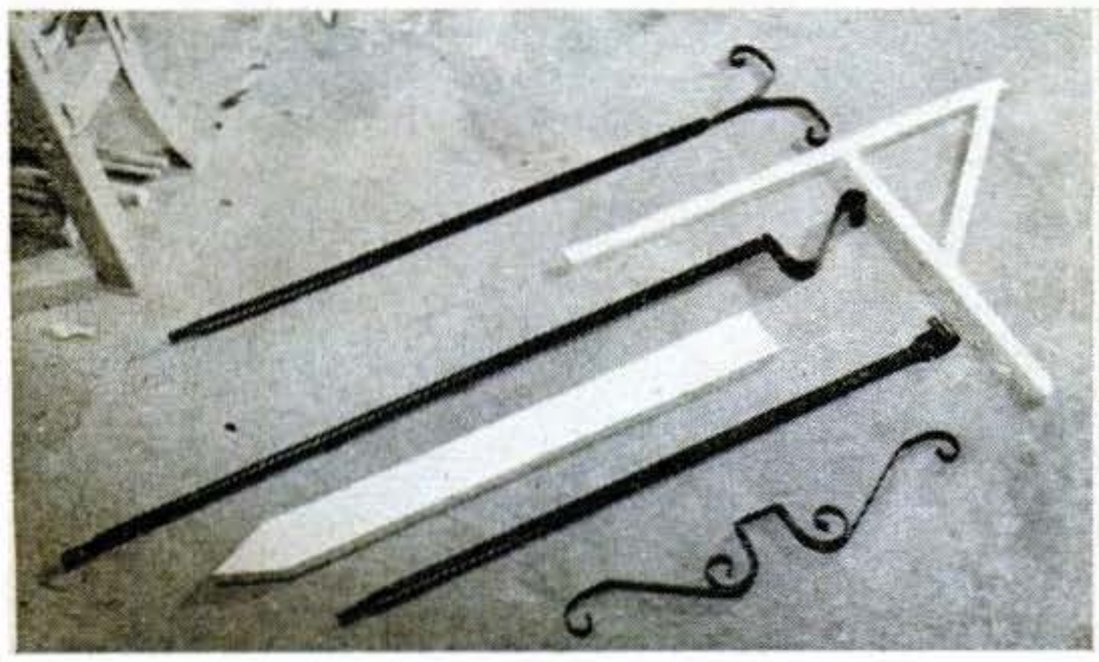
How to Make a Cut-Out or Silhouetted Sign

Simplest cut-out sign consists of individual letters, spaced to please the eye. A script name may be enlarged and jigsawed from one piece.

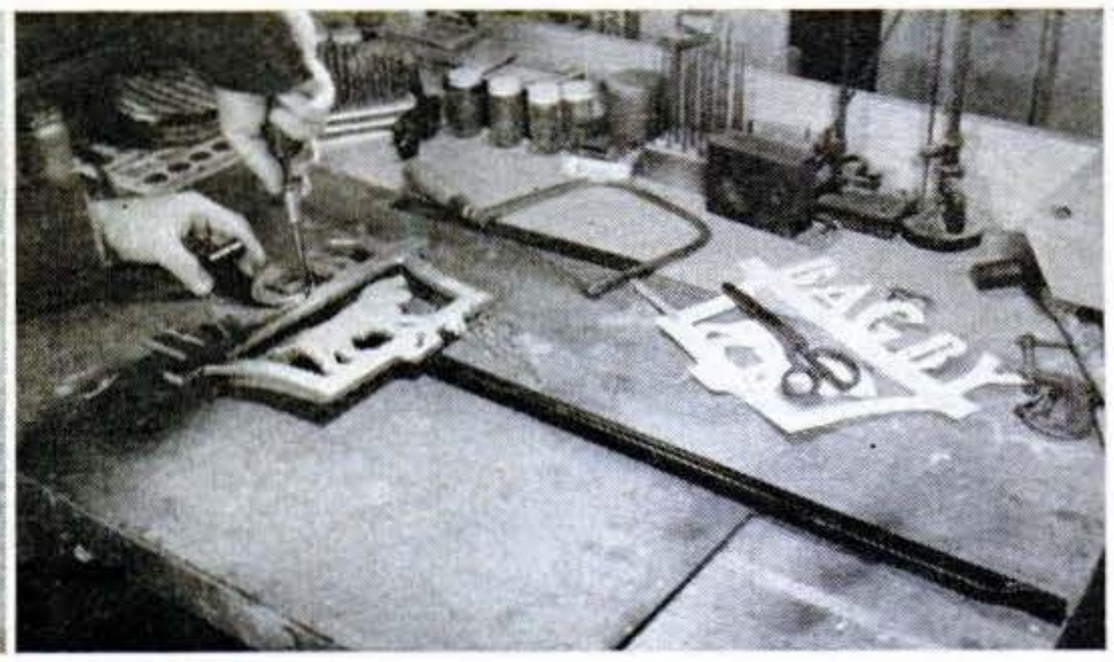


For silhouette sign, trace or rubber-cement pattern on hard Masonite. Drill holes for inside cuts. Sheet aluminum or brass could also be used.

Give cut-out sign two coats of black, white, or aluminum paint. Color choice depends on background against which the sign is to be set off.



Stake may be metal or wood. Figure-four bracket is easy to build. Wrought-iron ones call for blacksmithing, but can be bought ready-made.



Mount sign on stake with bolts. Neat trick is to fasten sign to clear-plastic panel and bolt panel to stake so sign appears to float.

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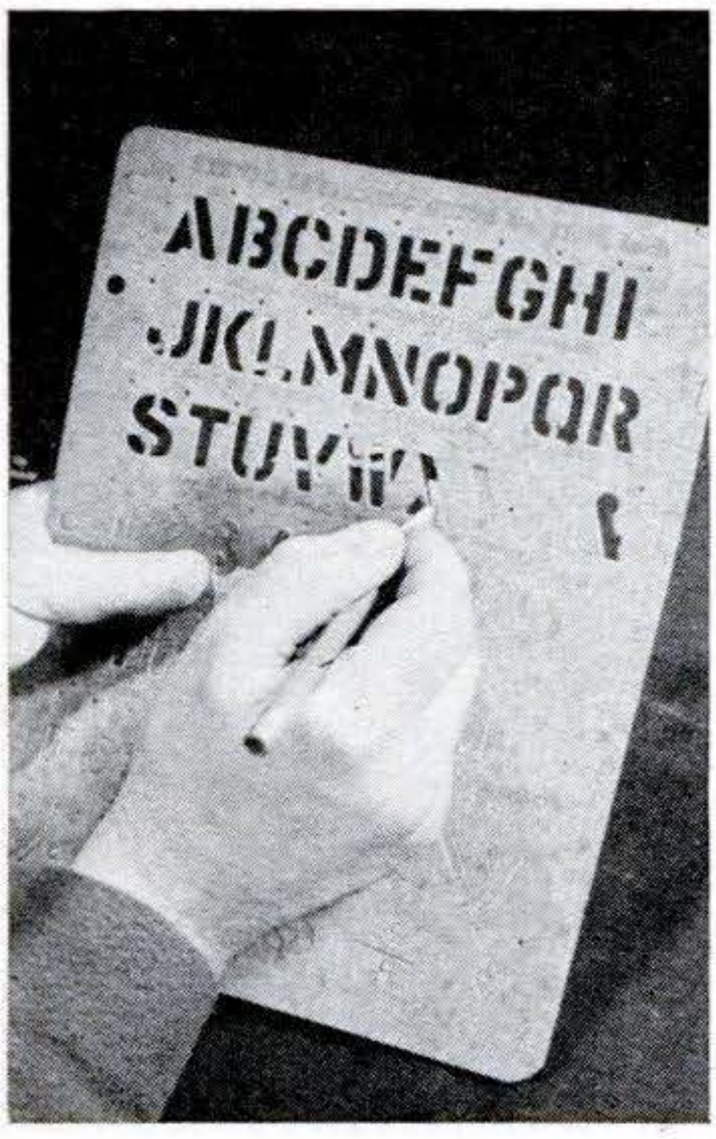
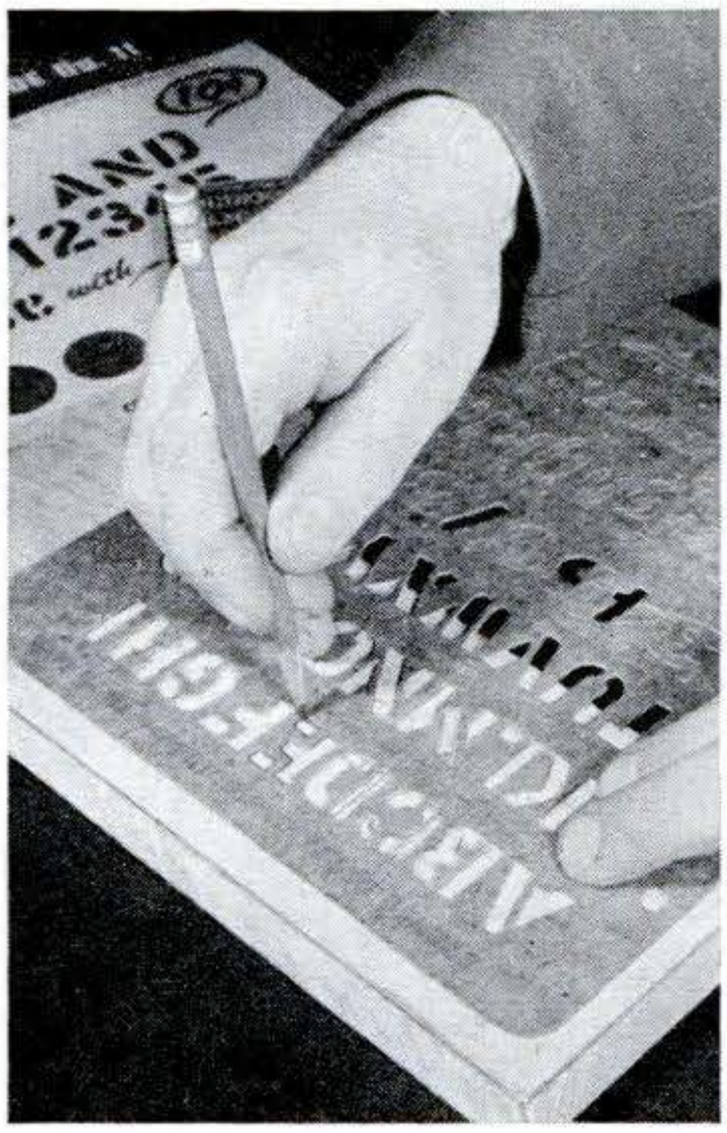
Stencil Signs Are Simple to Make

In signs to be visible from both sides, lettering must not be silhouetted or it will read wrong from one side. For mailboxes, or quickie signs like "PLEASE KEEP OFF" for a lawn, stencils can't be beat.



You can buy stencil sheets at stationery stores. Push out paper stampings to open the letter cutouts. Then rule guide lines on the signboard.

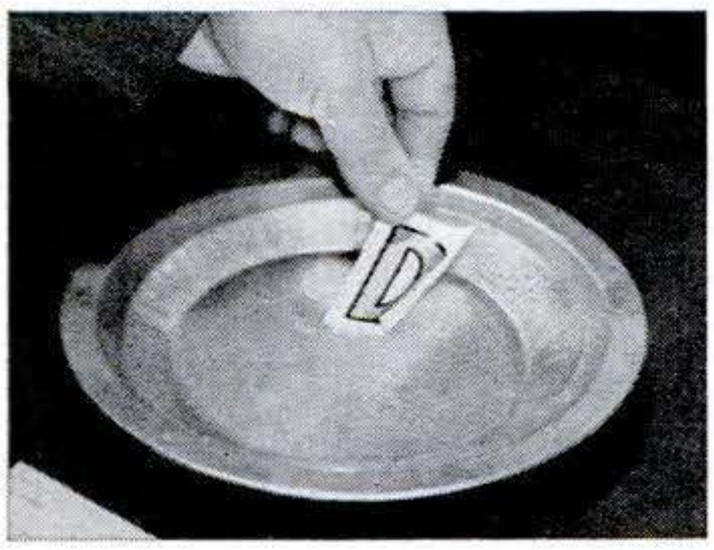


Place stencil so line shows through holes above letters. Trace letter and its right-hand hole. Align hole tracing with left-hand hole of next letter.

Fill in letters with paint or enamel for outdoor use. Indoors, crayon or ink will do. If you don't want stencil effect, paint right across tie gaps.

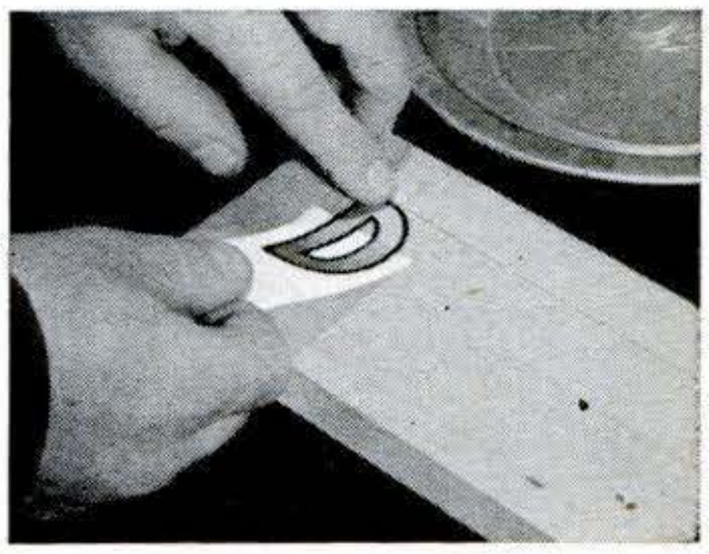
Decals Can Be Used on Outdoor Signs

Neat outline lettering is easy with decal letter transfers. For outdoor use, brush a thin coat of spar varnish on the signboard and let it dry. Apply the decal and, when it's dry, another coat of varnish.



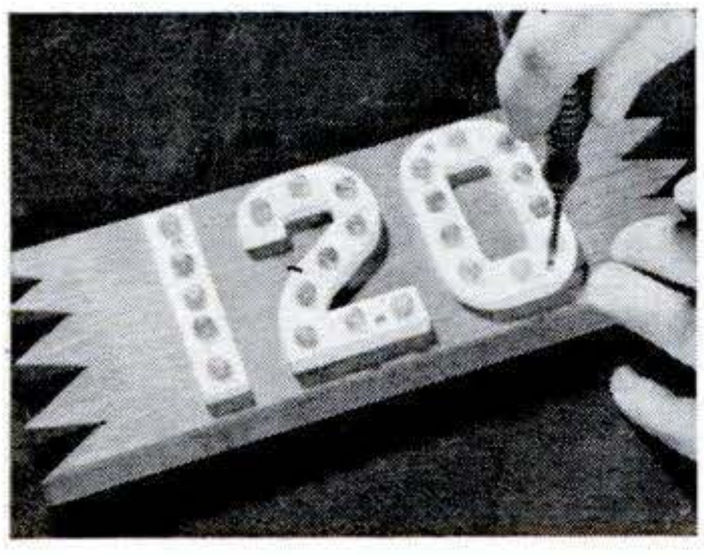
Dip the decal in water, remove it, and wait one minute for it to loosen from the paper backing. If it still sticks, dip again. Don't pry or pull it.

Place decal face up on board. Holding letter down, draw backing out. On glass or plastic, apply decal face down, and remember to spell right to left.



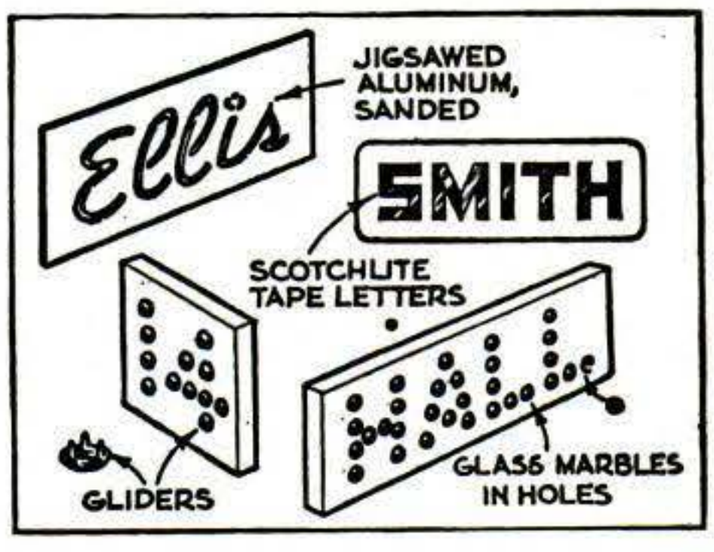
You Can Make Signs that Reflect Light

Signs like this command attention at night. You can buy reflecting letters and numbers and mount them on a clear-pine board. Finish the board with oil stain, or sealer and two coats of paint. If you cut jagged ends on it, sand and finish the inside of the cuts thoroughly.



Use wood screws (left) to fasten letters to the board. For best exposure to auto headlamps, reflecting signs should be set 18" above the ground.

Sanded aluminum reflects light. Scotchlite reflecting tape is more effective. Cut and fold it to form letters. Furniture gliders and marbles can be used too.



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Low-Cost Spindle Grinder for Your Lathe

For little more than the price of two small single-row ball bearings, you can have a toolpost spindle grinder that will enlarge the working scope of your lathe. The photos show such a grinder belt-driven from a flexible shaft, which can be connected to the lathe motor. A separate motor could be mounted on the base of the drive support, powering a shaft at lathe-center height. Pulley ratios should provide the spindle speed recommended for the grinding wheel you use.

Bore out a 4″ length of standard 1″ pipe to 1 1/16″, machining the outside only enough to clean it up. Shape a matching radius on the housing support either by filing or by mounting the support in the toolpost and running it against a rotating fly cutter.

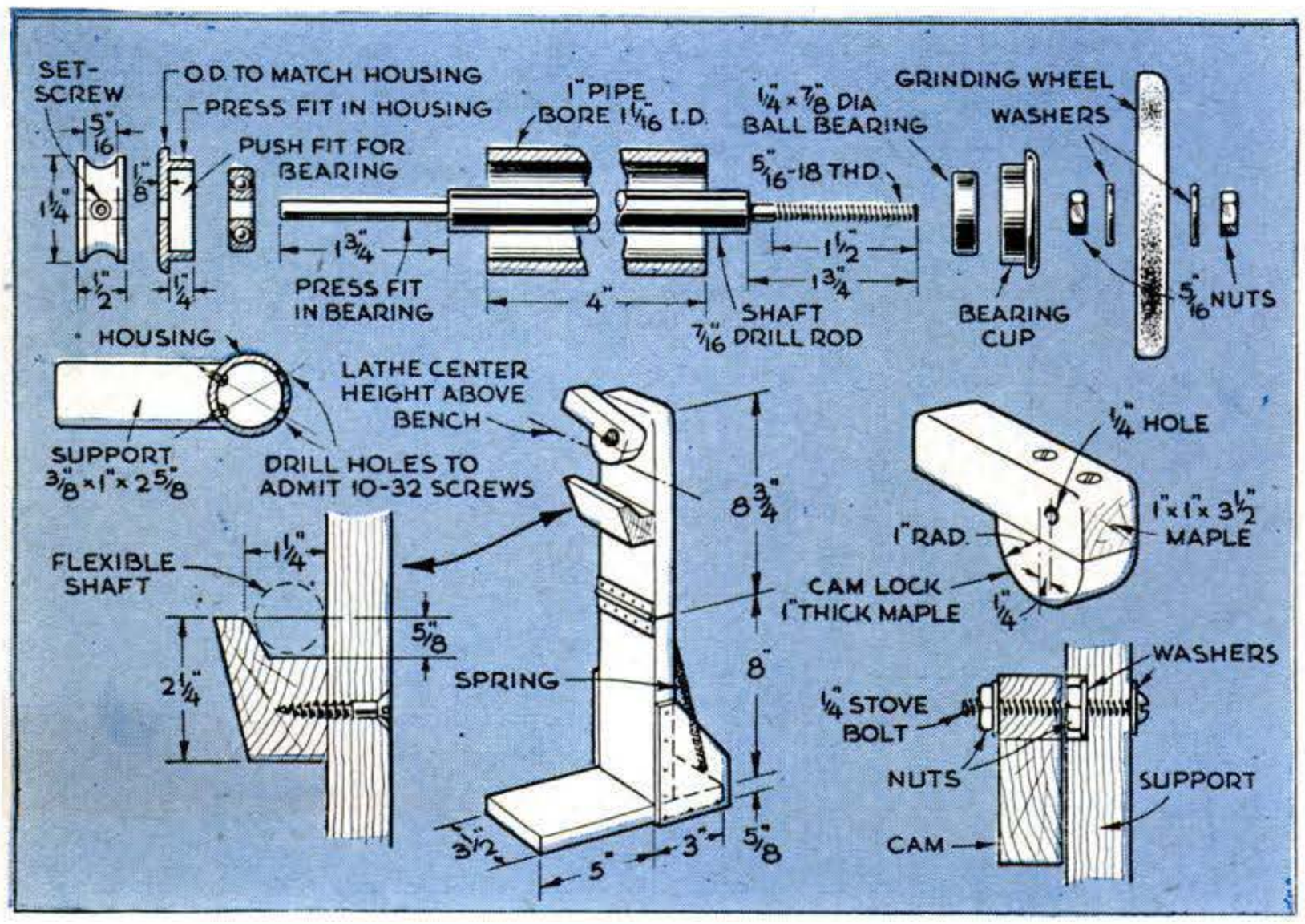
Mount the housing with screws inserted through entry holes as in the drawing. Plug and solder these holes after assembly. The joint may be silver soldered or brazed for additional strength.

Bearing caps are turned from brass or mild steel to an outside diameter matching the housing. Turn the shoulders to a press fit in the housing, and the bore to a close push fit for the ball bearing. At the same chucking, drill the shaft hole in each cup. Make this a close fit to keep abrasive dust out of the bearings.

Chuck a 7″ length of 7/16″ drill rod true, preferably in a collet, and turn down both ends to a press fit in the bearings. To prevent end play, the between-shoulders dimension should be such that .005″ clearance remains between the housing and one bearing shoulder when the unit is assembled. Thread one end of the shaft in the lathe.

Pack the bearings with grease before assembly. Turn a brass pulley to fit a ¼″ round leather belt, and mount it with a 10-32 hollow-head setscrew.

Build the drive support to lathe-center height so that the belt will encircle work mounted between lathe centers. The hinged section, pulled back by a screen-door spring, keeps belt tension constant as the grinder is moved.—*A. Wayne Argabrite, Denver.*



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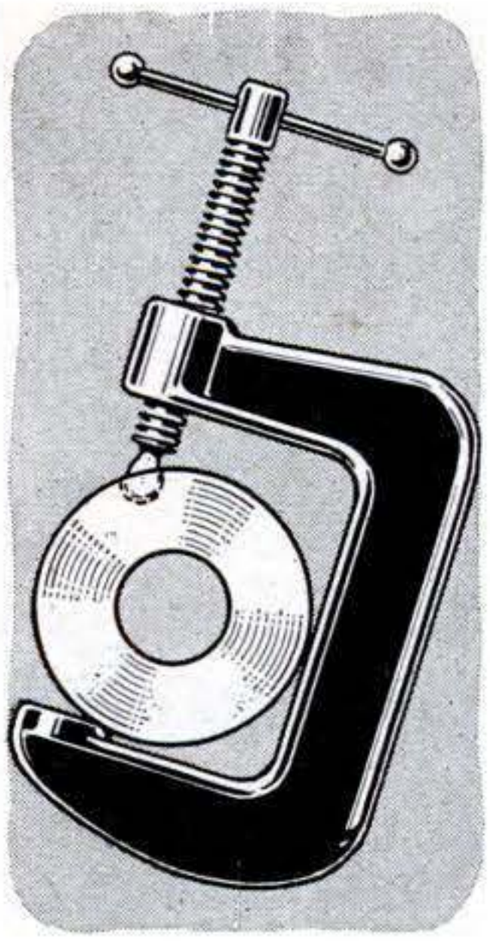
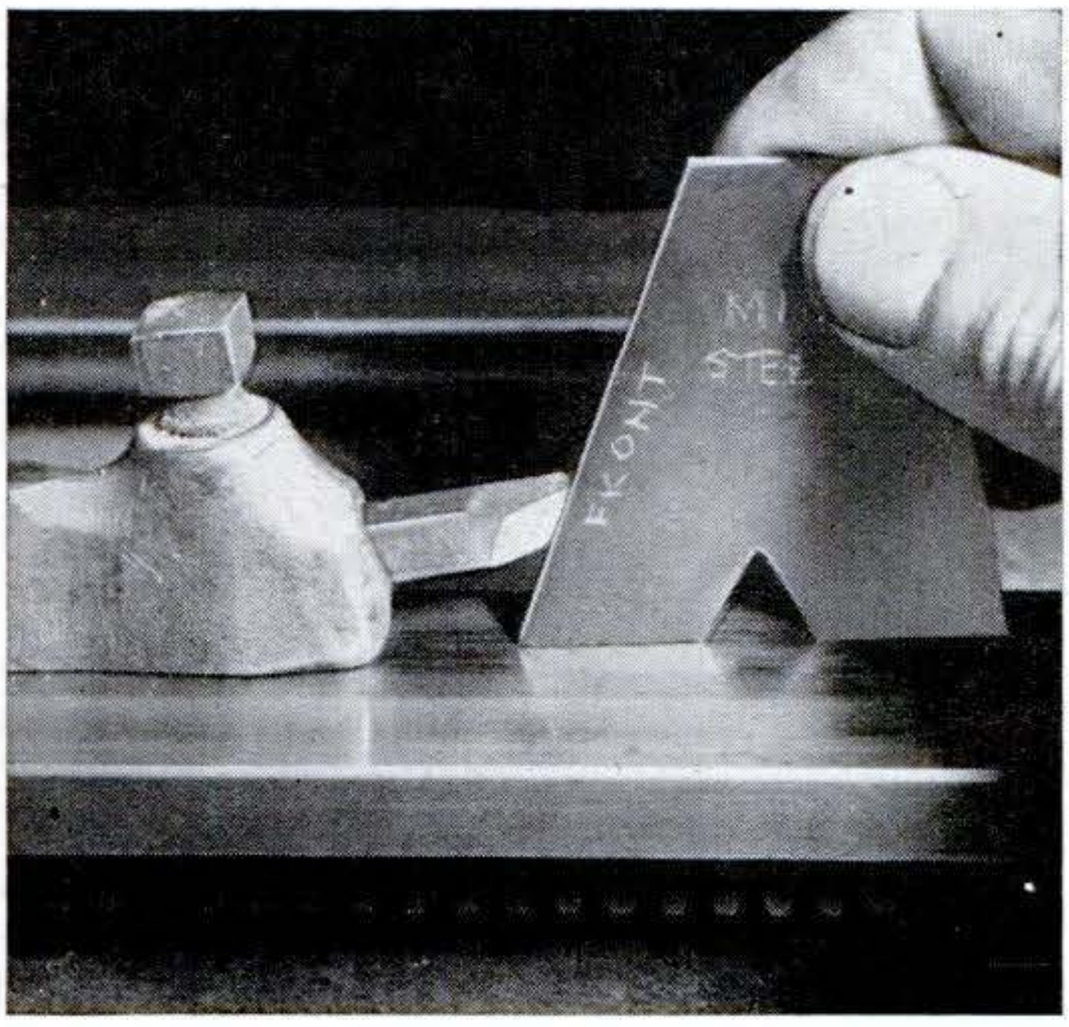


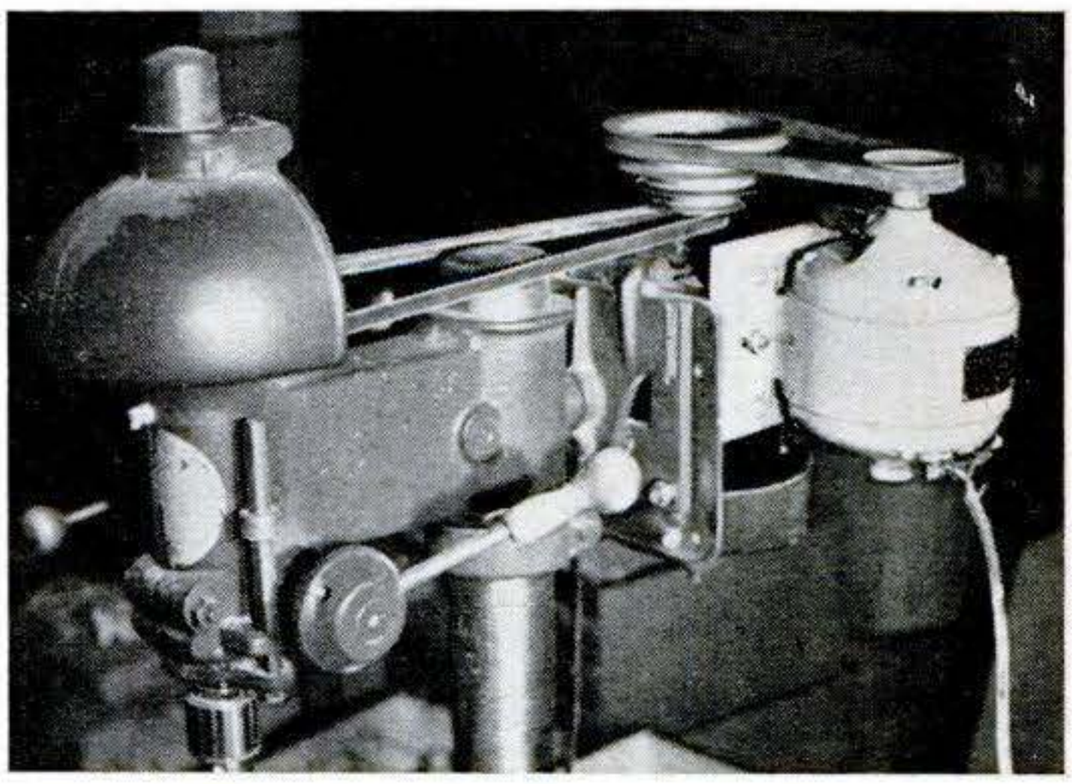
Emergency Spanner. The round nut on my lathe has only a hole for a spanner, and can't be removed with a wrench. Lacking a spanner, I took the swivel foot off a C clamp and set it on the nut as shown. The ball end of the screw fitted the hole, and a few light taps on the other end loosened the nut.— *William Bernard, Cincinnati.*

Gauges Check Tool Angles. If you have trouble grinding lathe bits freehand, simple angle gauges may prove helpful. With them, you can check side and front clearance angles while the bits are in tool holders, as they are in use, and need not compensate for the holder angle.

Make a gauge for each of the materials you commonly machine. Lay it out on sheet metal with a protractor, cut outside the lines, and carefully file to them. Black-surfaced stock is good as it lets you scribe identification marks.

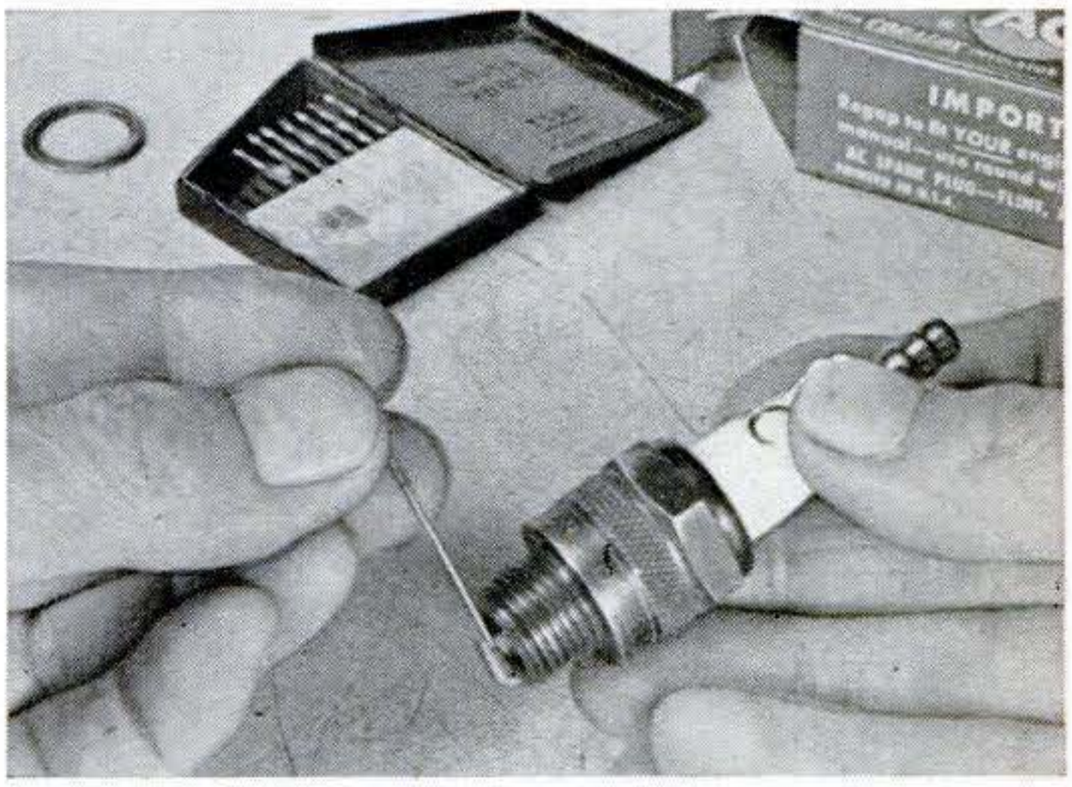
A tool can be ground in the holder, provided it protrudes enough. Grind front and side clearances first. Check against the gauge with the bit in a holder, as shown. Then grind the side rake to give the required angle of keenness. Hold the gauge vertical, base down on a flat surface. A light behind it helps compare the angles. Tool data can be found in any lathe operator's handbook. —*Will Thomas, Buffalo.*





Piggy-Back Speed Reducer. If you have or can borrow a spare ball-bearing motor, you can easily convert your drill press to low speeds for milling, drilling big holes, using fly cutters, and similar jobs. Simply mount the extra motor temporarily to drive the regular one, which is left unpowered, as a jackshaft.

A plywood base for the extra motor can be fastened by angle brackets to the end-bell bolts of the other one, as shown above. If this isn't handy, the drill-press motor mount can be drilled for extra bolts and the base fastened to it. Align the power pulley with the biggest step of the regular pulley. Use only a motor approved for vertical operation.—*Walter Keys, Seattle.*



Drills as Feeler Gauges. Need a small round feeler gauge? If a set of No. 61 to No. 80 drills is at hand, you have a set of such gauges ranging from .039″ to .0135″, in increments of one to two thousandths. You can measure them with a wire gauge or micrometer, or get the sizes from tables in machinist's handbooks. Such round feelers are good for setting engine distributor points, spark-plug gaps, and relay or regulator contacts. However, use only drills in good condition.—*Harry L. Truchelut, Atlanta, Ga.*

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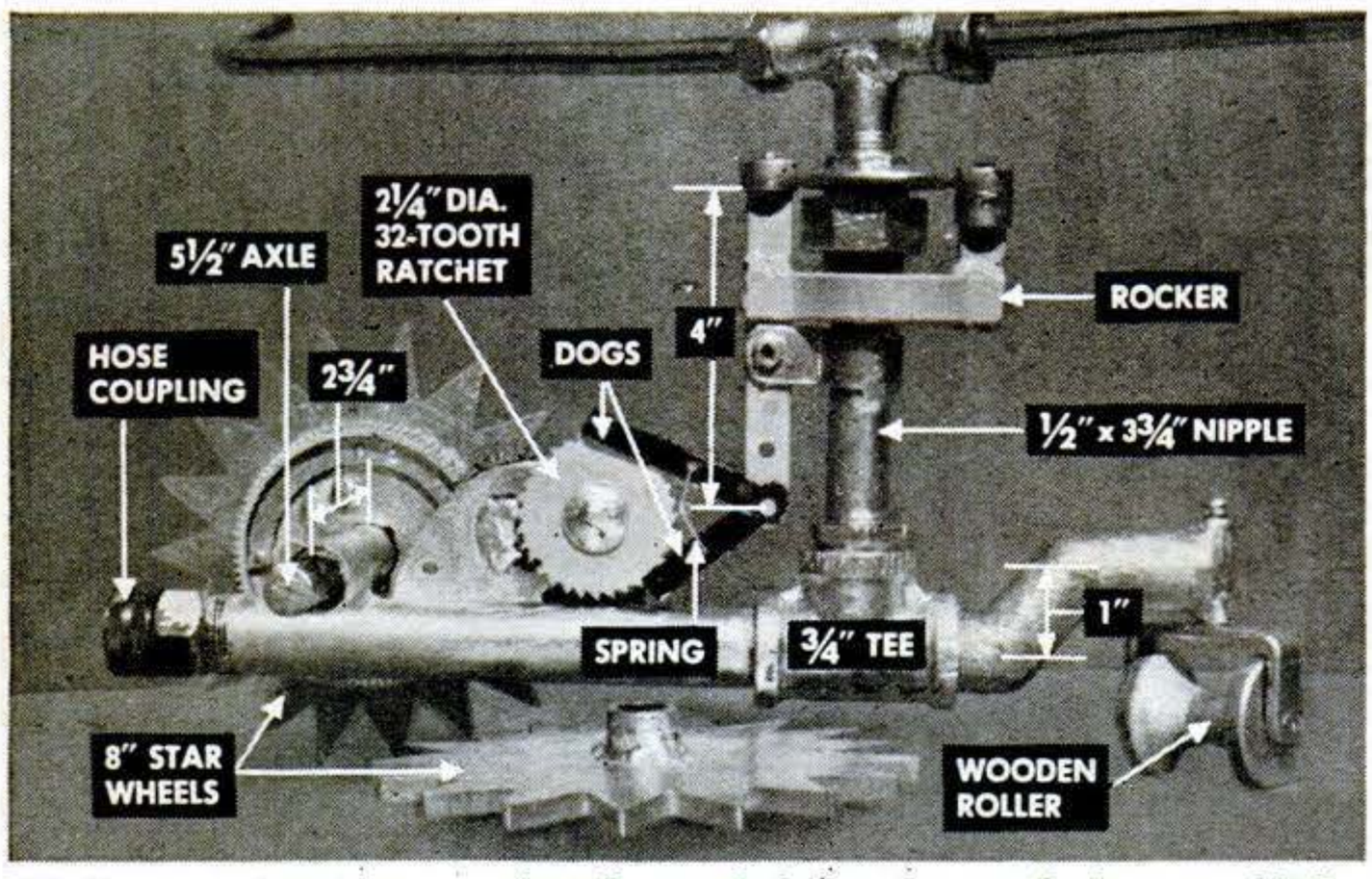
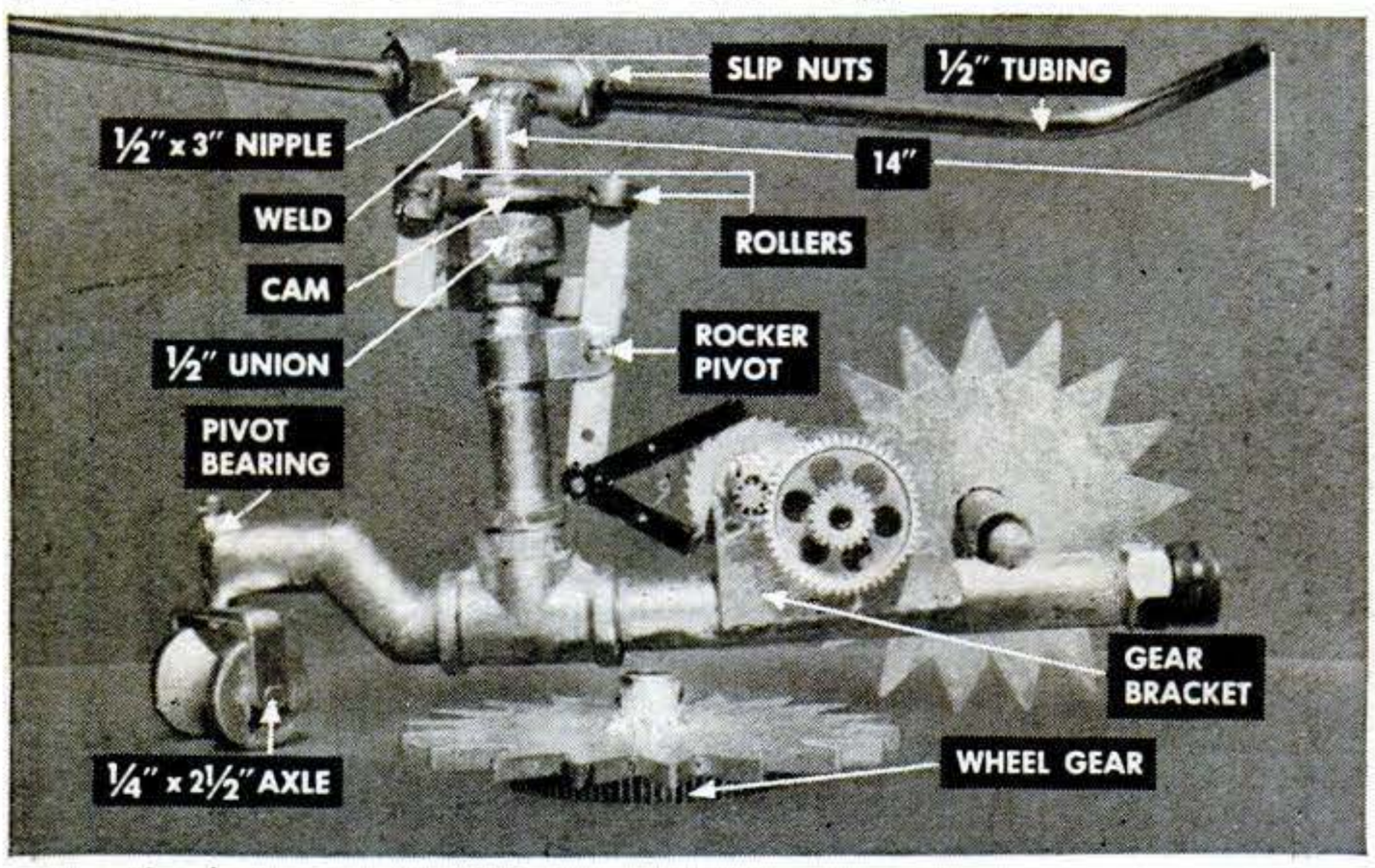
Walking Sprinkler Shuts Itself Off

ROBOTS are better than people—for some jobs. Why water your lawn by hand, or rush out every so often to move an ordinary sprinkler? I don't. This self-propelled one walks any course I lay out, and when it's finished, shuts itself off. Unlike me, it can't go off and forget.

The shutoff valve is connected to the water outlet, and the sprinkler is attached to the valve by a long hose. This is laid to the watering pattern desired. Then the sprinkler is set astraddle the hose and headed toward the valve. It walks at about 25 feet per hour, dragging a loop behind it. When the rotating arms hit the valve trigger, a spring-loaded handle shuts off the water.



Walking wheels were bandsawed from ¼" steel, but could be cut from dural or even resin-bonded fiber, as long as weight is added at this end to provide traction. Both wheels are pinned to the axle. The drive gear is mounted on one of them. Nut and lower part of the union are stationary.



Power for the wheels comes from the sprinkler head, which rotates on the familiar jet principle. A cam on the head alternately strikes two rollers on a rocker assembly carrying two dogs. These ride a ratchet geared to the wheels. I used gears from an old water meter, but any that will give an over-all reduction of 25 or 30 to 1 will do. The ratchet was hacksawed and filed from steel plate. I used welding, but with a little extra work you could bolt or rivet the parts together.

Starting with the ¾" tee, screw an 8" length of pipe into one end, and screw a 3½" length, bent as shown, into the other. To this weld a bushing or small pipe as a fork bearing. Bend the fork of strap iron, and weld on a pin or bolt as a pivot.

A ½" nipple threaded into an adapter in the center opening of the tee carries the union that forms the rotating gland. The part on which the union nut screws goes on the nipple. Deform a thread or two on it to make sure that the nut will jam. The upper part

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of the union turns on its ground joint.

Solder a 2″ washer 3/16″ off center on this part for the cam. Lubricate the union with water-pump grease and adjust closely while leaving it free to turn.

For the rotating head, I made an external-thread tee by welding together a 3½″ and a 1½″ nipple. The sprinkler arms are ½″ tubing, with a soldered-wire wrapping to make them fit the tee. They're held by slip nuts like the glass in a water gauge, and so are adjustable. You could simply solder them into an ordinary tee, and carefully bend them to adjust the spray.

For the nozzles, drill ⅛″ holes in short plugs to 1/32″ of the end, countersink, and hacksaw across the blind end ⅛″ deep. Solder the plugs in flush with the ends of the tubing.

Although I cut the 18-tooth star wheels from ¼″ steel, you may be able to adapt lawn-mower or toy wheels by studding the rims with bolts. Attach the final gear to one wheel, and pin both to the axle. Don't weld on the axle bearing until the gear bracket is in place and tooth spacing can be determined.

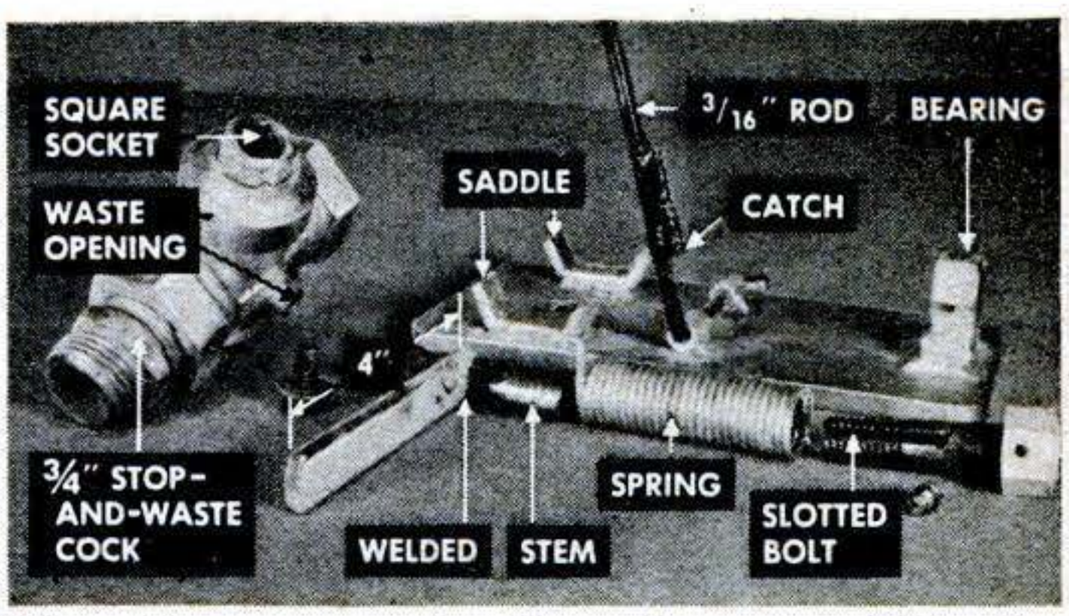
Pivots Must Fit

One cam roller is longer because it sweeps through a greater arc than the other. The vertical rocker arm has two holes for the dogs. Set into the upper hole, they move the ratchet one tooth at a time, in the lower, two. One dog should drop into position just before the other completes its stroke. The spring holds the lower dog up. Pivots must fit well to reduce lost motion.

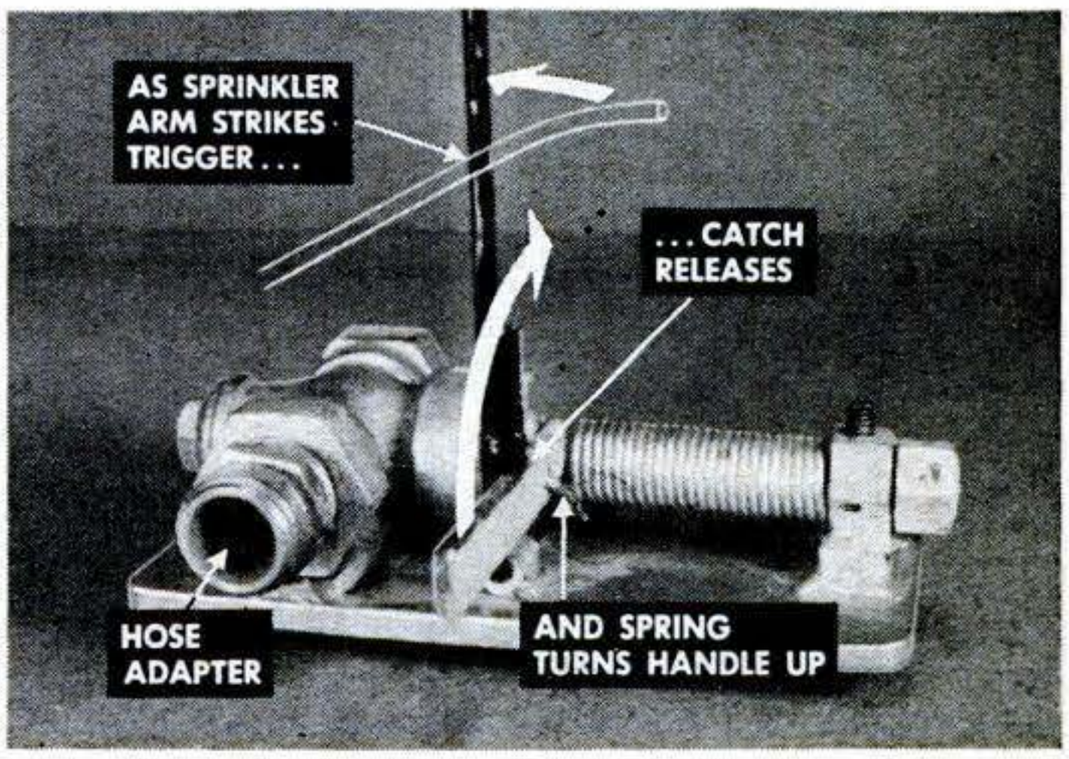
On my sprinkler, the ratchet shaft turns in a bushing soldered to the bracket, and the intermediate gears on a stub shaft, but this may vary with the gears available.

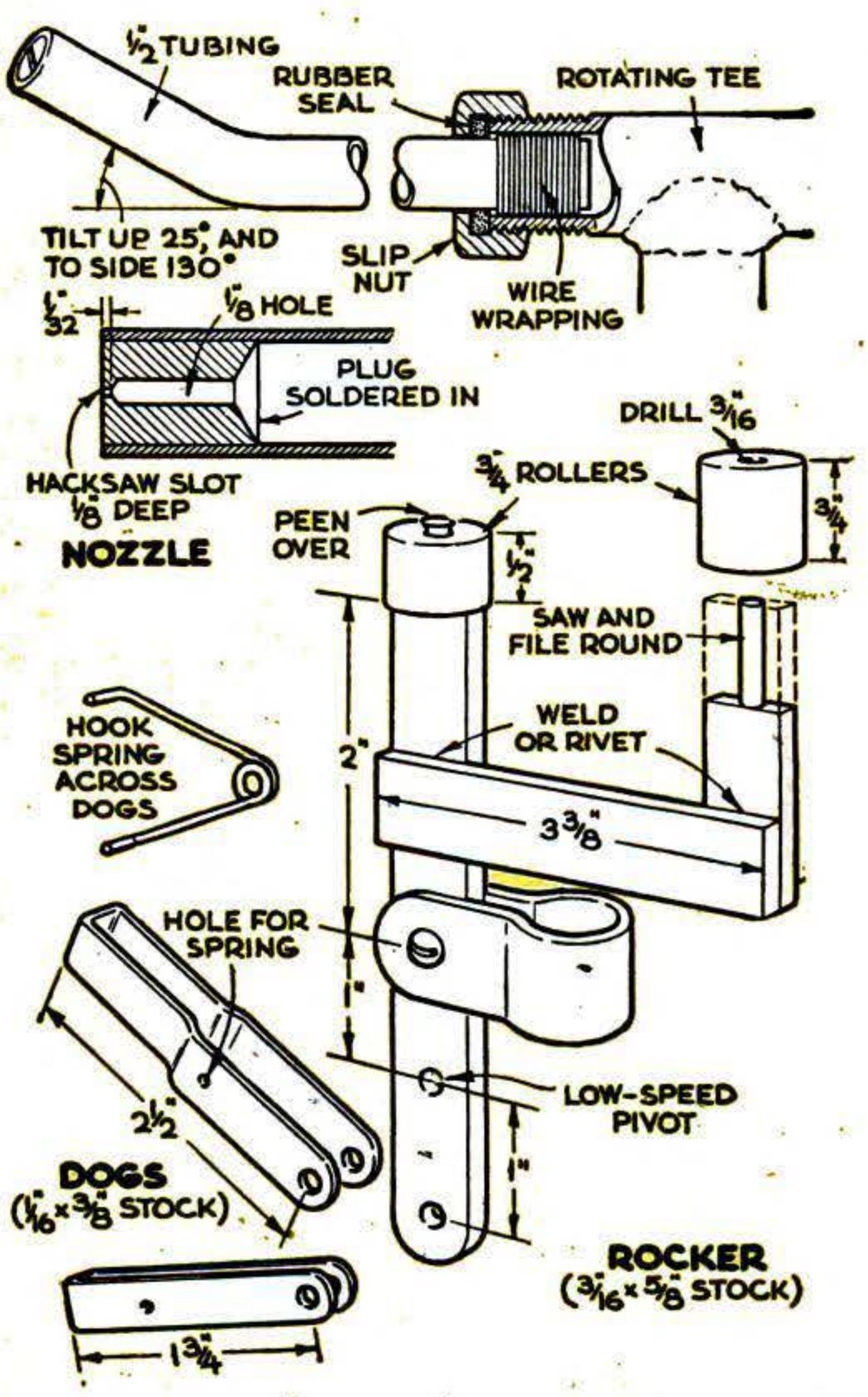
A ¾″ stop-and-waste cock forms the shut-off. Solder or weld clips on a base to form a saddle, and hold the valve down with a screw through the base into the waste opening. Lubricate the plug for free action. File a ½″ rod square to fit the socket. Weld or solder a 4″ handle to this stem.

At the other end of the base mount a ½″ bearing (I used a nut reamed to size) and tap it for a setscrew. Pivot the trigger rod in two clips, and solder an extra bit of rod on as a catch to hold the handle against spring tension. Set the spring to turn the valve off gently. Finally, fit hose adapters to the two sides of the valve.— *Keith Heryford, Cedarville, Calif.*



How the automatic shutoff works. File the end of the catch to release easily. One end of the coil spring is bent across its diameter to fit into a slot in the bolt. The other is inserted in a hole in the stem handle.





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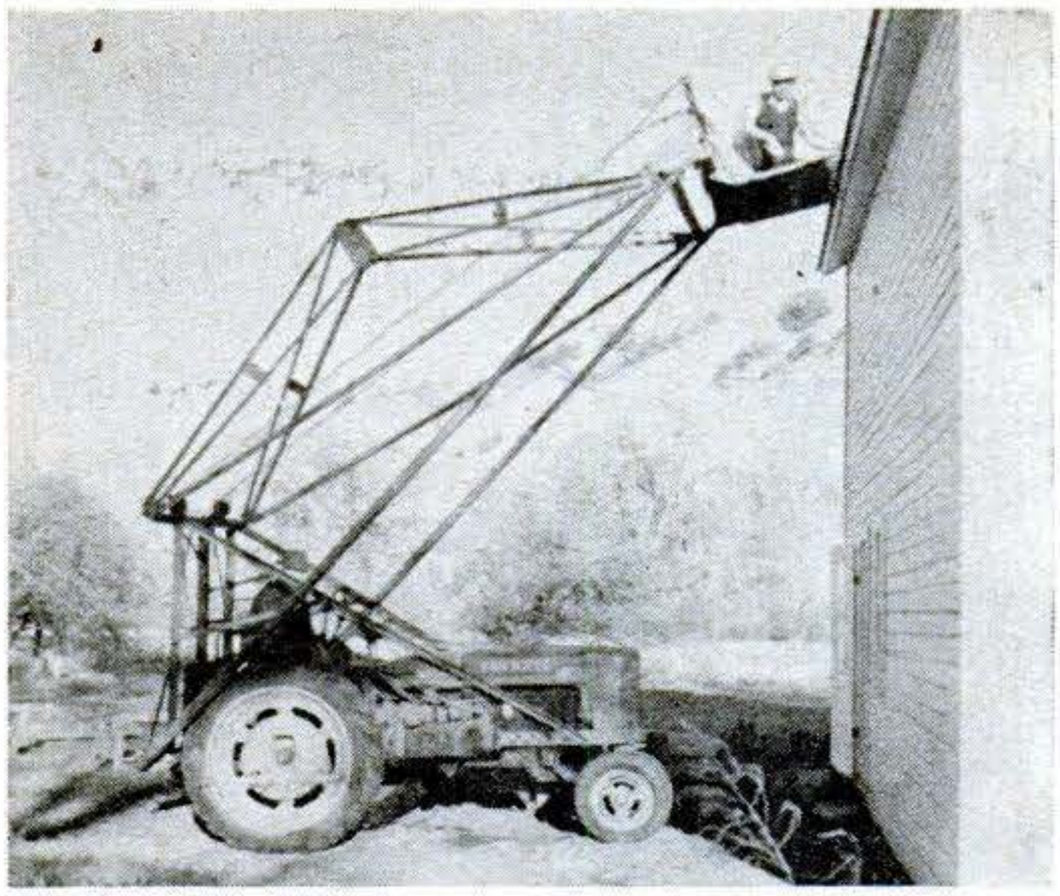
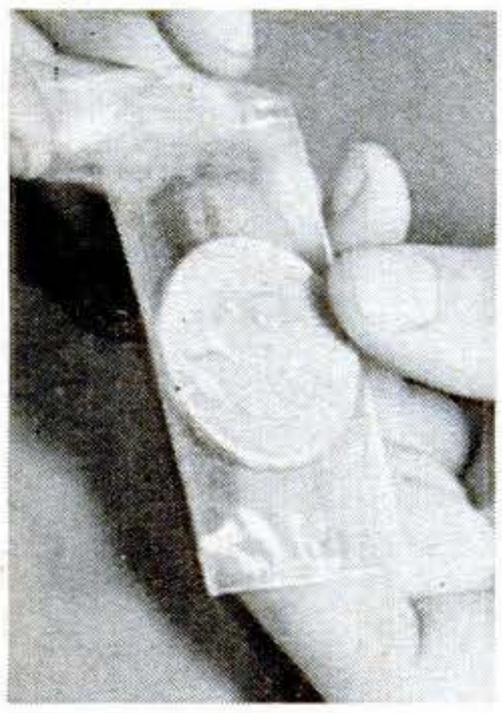
Tractor Loader Serves as Scaffold



WHEN he has to repair a roof, James D. Reyner, of Silver Star, Mont., drives his tractor's hydraulic loader right to the spot. Mr. Reyner reports that the scoop stays raised for a considerable time even though there's no operator at the controls. He does need a helper to get him up and to move the scaffold to a new position.

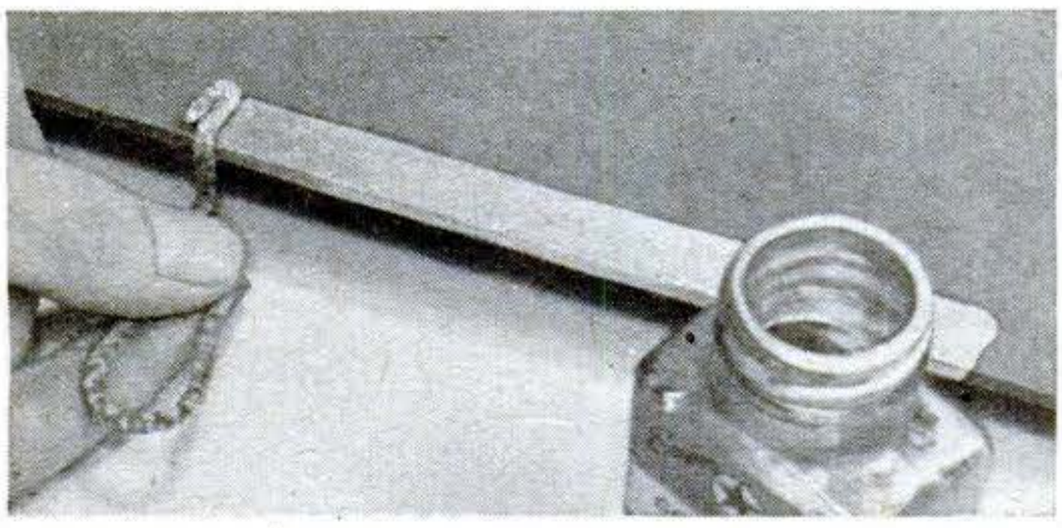
Tip for Coin Collectors



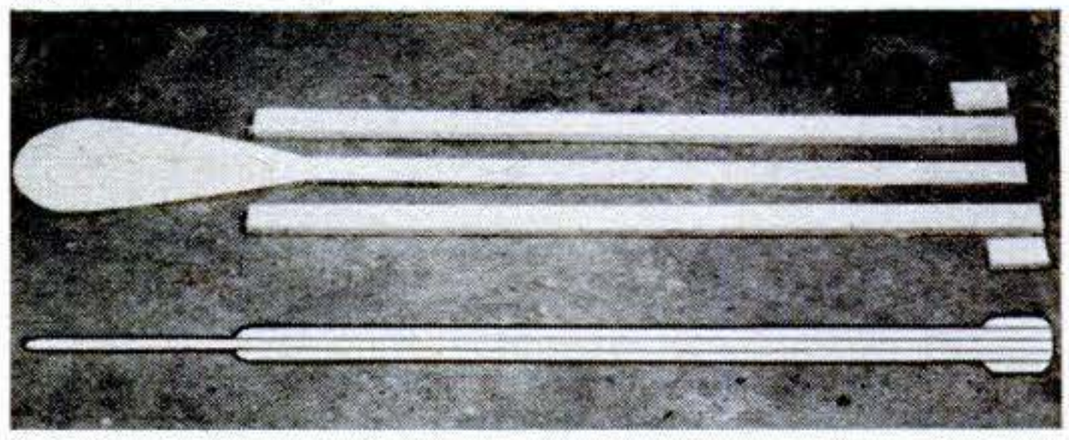
COIN collectors can protect newly minted coins from handling and tarnishing by sealing them in small cellophane bags. Cream-test bags, obtainable at cream stations or creameries, are just right for this. *—Don Nielsen, Aurora, Neb.*

Pipe Cleaner Makes Edging Brush

A PIPE cleaner makes a fine brush for painting or gilding border edges. Fold back one end of the cleaner the depth of the edge desired, and bend down the cleaner sharply. Dip the fold in the paint and carefully move it along the edge. With a little practice, a very good job can be done.—*R. Hanscom, Elmhurst, Ill.*

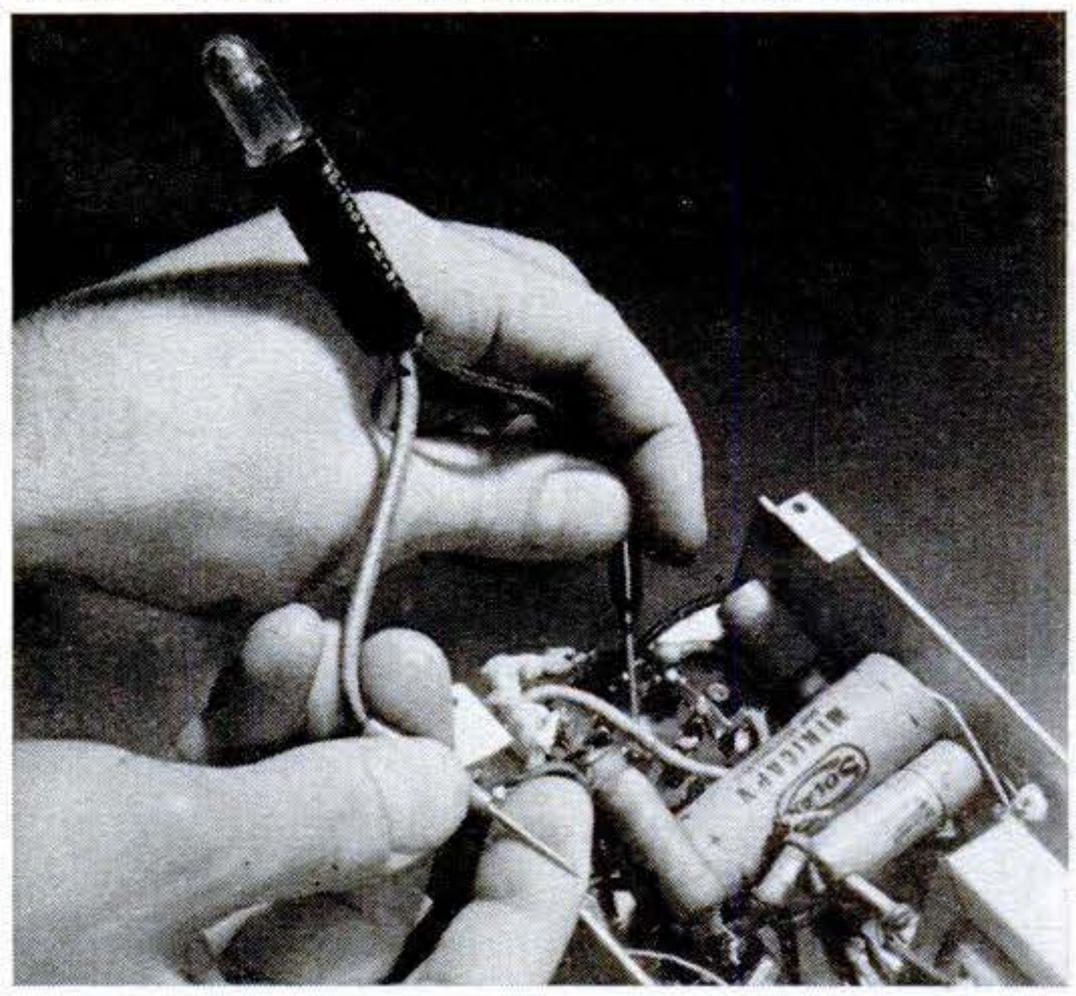


Simple Way to Make a Paddle



A STRIP of marine plywood glued between two pieces of wood lath made the paddle shown here. If you want to, glue two small pieces to the end of the handle to make a knob. Use a waterproof glue. After the glue has set, shape the paddle with a spokeshave or knife, sand it smooth, and give it two or three coats of spar varnish.—*Jim Miller, Moline, Ill.*

Your Body Is Part of Test Circuit



YOU don't have to hunt for an outside ground when you check the "hot" side of an AC line with a neon tester. Just touch one lead to the hot line and hold the other. Your body will act as a partial ground and make the neon bulb glow feebly. The resistance of the neon tester is so high there's no danger of a shock, but don't try it with anything else. Some servicemen use this trick to locate burned-out tubes in series, to polarize line plugs, and to find breaks.

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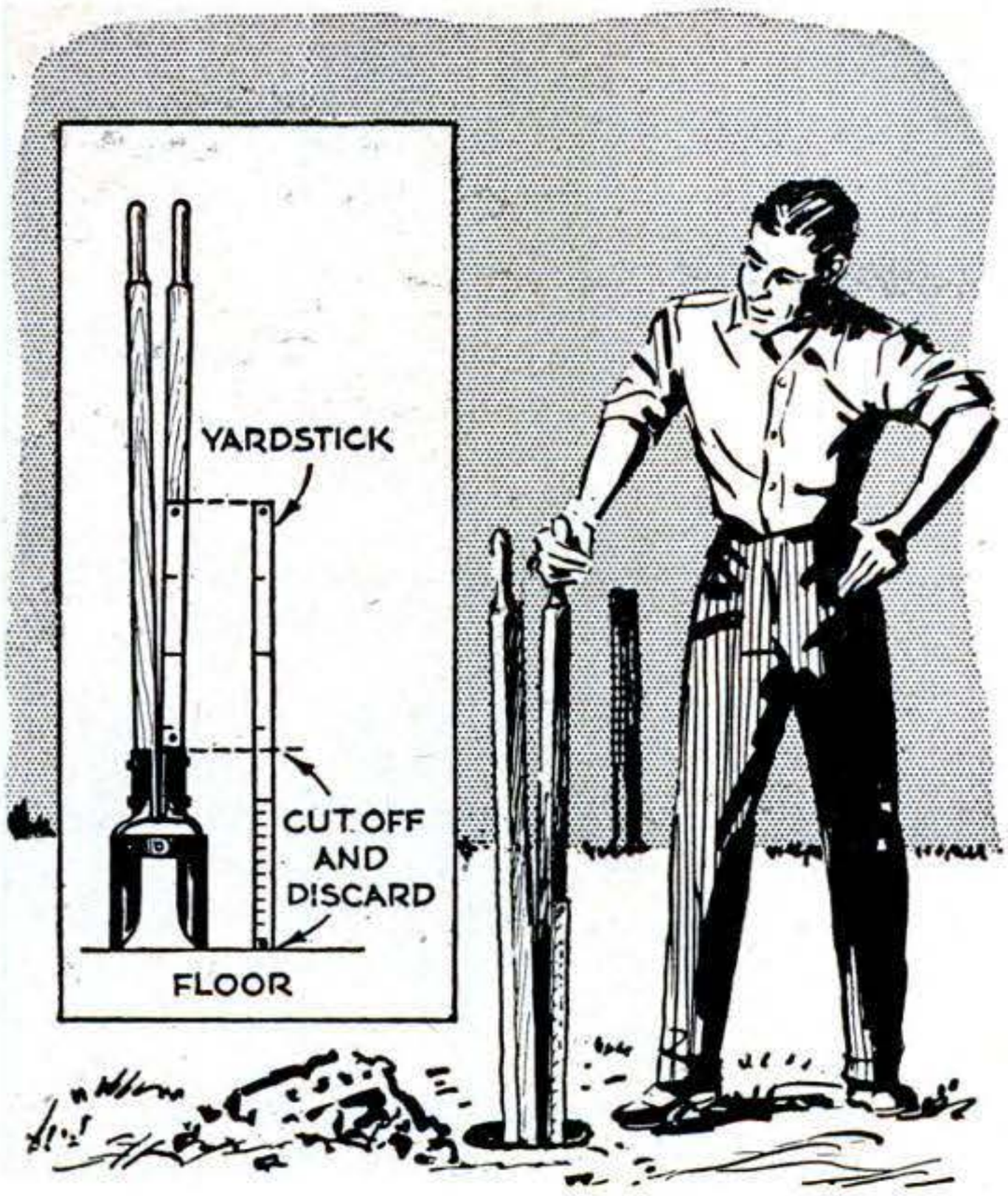
Yardstick Gauge Measures Post Holes



THE top part of a yardstick tacked to one arm of a post-hole digger as shown above makes it easy to dig uniform holes. A glance at the stick shows how deep you have dug. —*Albert Zanelli, Wyckoff, N. J.*

Glue Stops Films from Sliding

ADJUSTABLE roll-film tanks will handle two or more rolls at a time. But during agitation, a roll loaded from the outer edge may slip and overlap a roll loaded from the center. This can ruin several exposures.

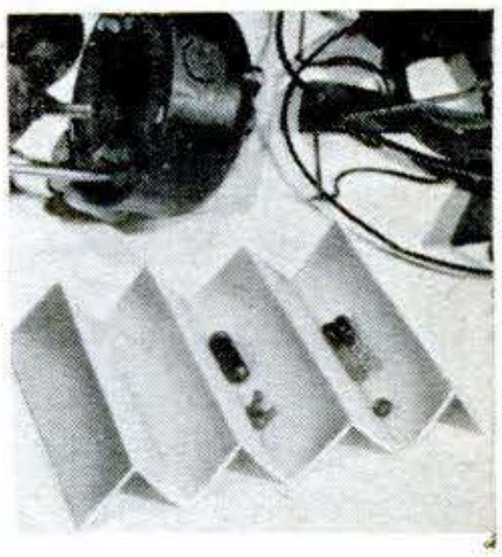
To prevent such accidents I made stops with dried glue. I loaded a developed roll from the center and marked where it ended. Then I loaded the roll from the outside and marked the inner end. I then squeezed glue into the groove midway between these points.—*Darrell Huff, Sonoma, Calif.*

Foil Wrapping Protects Paint Brushes

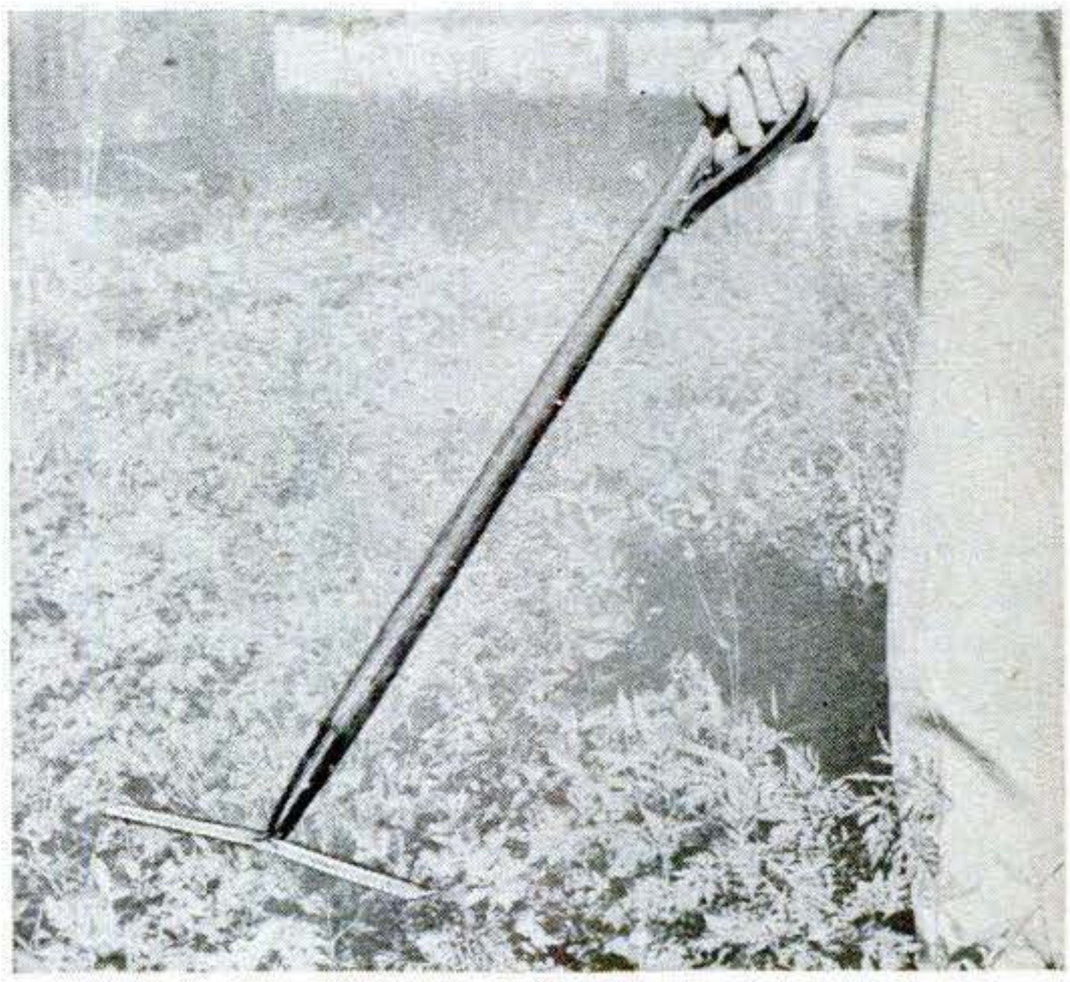
FOIL wrapping from photographic film is ideal for protecting paint brushes. Use it as a dustproof covering for clean, dry brushes, and an airtight covering for wet brushes that must be kept overnight.

Paper Tray Keeps Parts in Order

IT'S often easier to take things apart than to put them together. Next time you have to handle small parts, arrange them as shown here in a tray made by pleating paper. The folds keep all the bits and pieces in sight, prevent them from rolling, and show you the order in which they should be replaced.—*Albert Griffin, The Bronx, N. Y.*



Hand Grip Makes Grass Cutter Safer



A GRASS cutter of the type shown can be a dangerous weapon if it slips from your hand while in use. A leather strap or a piece of belting or webbing attached to the handle is a simple safety measure. Double a 14″ length of the material and fasten it to the handle with a broad-headed screw, or with a stout nail set through a washer. Slip your hand through the loop and the cutter won't get away from you if you get careless or hit a tough weed or a stone.—*G. R. Hunter, Quitman, Ga.*

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P.S. Last minute news & notes...

ROCKETMEN, who dream of sending up a satellite that would circle the earth like the moon, point out that it could serve as a TV relay station as well as a place to keep bombs ready to drop on any enemy. Such a sky platform, says William B. Bergen, a Glenn L. Martin Co. engineer, could relay a TV program to half the world.

BY DIALING 3-1-8, then dialing any San Francisco telephone number, residents of Englewood, N. J., will be able to make transcontinental telephone calls this fall without speaking to an operator. Other code numbers will connect Englewood with Boston, Chicago, Philadelphia, Cleveland, and Pittsburgh. But people in these cities can't call back to Englewood sc simply until the system is extended.

THE BRITISH-BUILT FORD Consul, described in PS for March (p. 150), is being introduced to U. S. drivers by Ford and Lincoln-Mercury dealers. It will retail in the $1,700-$1,800 range, at port of entry, for a five-passenger four-door sedan with a four-cylinder engine.

SOLDIERS won't make a face when they drink water made safe with tablets soon to be issued to troops in Korea. Containing iodine instead of chlorine, the new water-purifying chemical is more effective, too. Its full name: triglycine hydro-periodide.

100 YEARS AGO this summer, a Baltimore dairyman opened the world's first ice-cream factory. The ice-cream soda wasn't invented until 1874, and the ice-cream cone made its debut at the St. Louis World's Fair in 1904.

FUTURE AUTOMOBILE GREASE may contain sand--in tiny particles so smooth they serve as microscopic ball bearings. DuPont engineers are trying the new form of silica in place of soap to thicken oil. It makes a grease that has stood up in tests comparable to lubricating the wheel bearings of a truck driven for 10,000 miles of tight turns at 50 m.p.h.

"ANY AMERICAN with an idea for a new or better petroleum product or application" can now apply for permission to use the facilities of the Sinclair Oil Company's multi-million-dollar petroleum-research plant at Harvey, Ill., near Chicago.

WHEN YOU DREAM, do you see color or black-and-white pictures? Thousands of dreams have been studied at Western Reserve University--and 29 percent were in "Technicolor." But the psychologists don't know what, if anything, the colors signify.

WHETHER TO RECAP a tire needn't be guesswork. For large depots, a Goodyear expert recommends a "supersonic separation tester." Sound waves passing through the tire from a crystal vibrator in a liquid solution outside are picked up by a microphone inside. A green light indicates a sound carcass.

RADIO ENGINEERS believe Stalin would find it pretty hard to jam the Voice of America if we placed a ring of 14 1,000,000-watt transmitters around Russia. Each one would be 20 times as powerful as any commercial broadcasting station in the U. S. . . . GENERAL ELECTRIC engineers have developed a radio system for taxi fleets that lets each driver talk privately with the dispatcher.

THIS MONTH: The 18th National Soaring Contest will be held at Elmira, N. Y. The world's distance record is now over 450 miles, and the altitude record is 42,000 feet . . . LATER IN THE MONTH, the 20th National Championship Model Airplane Contest will be held in Dallas.

The Editors

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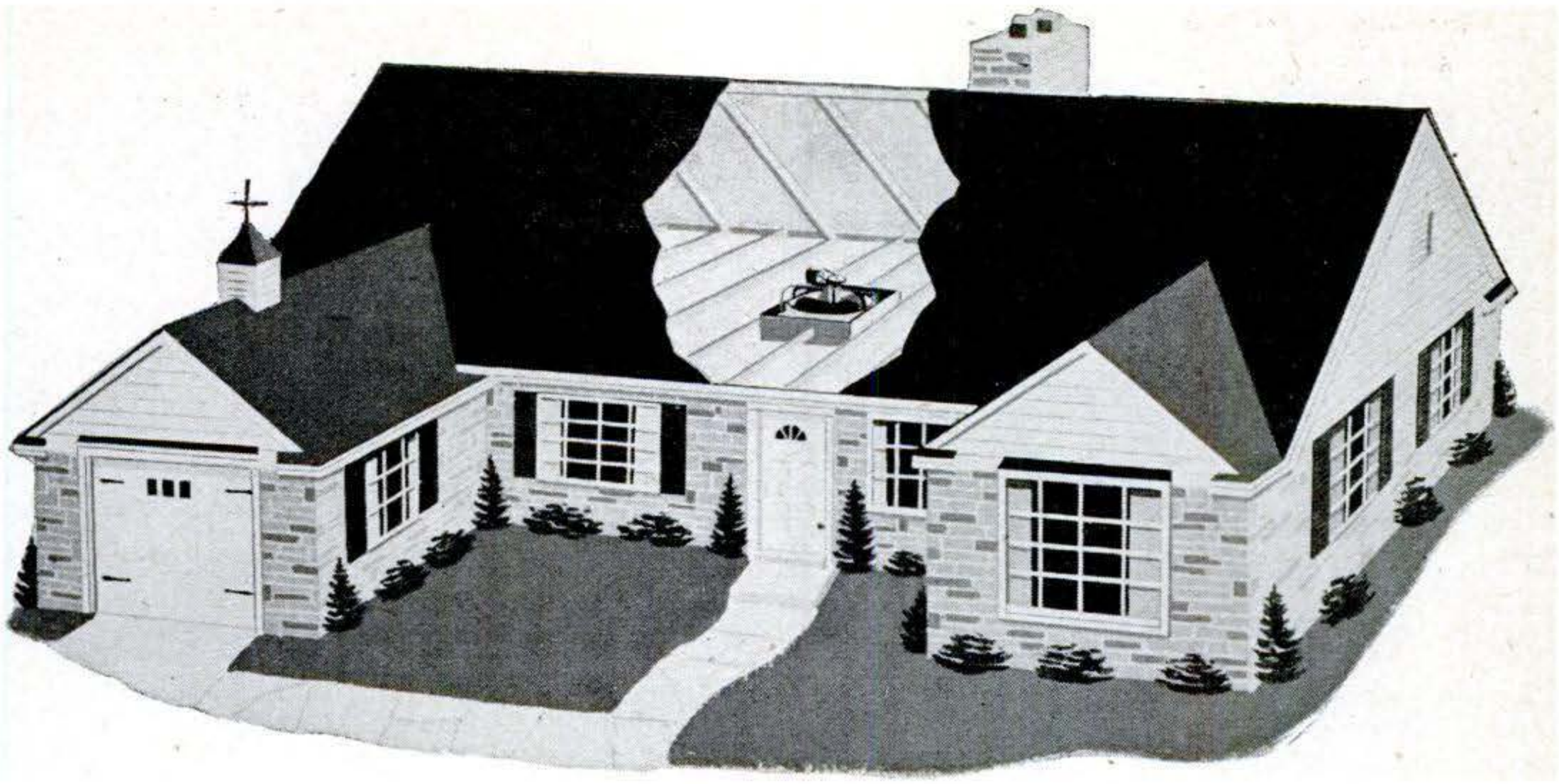


How to Install an Attic Fan

It is just as easy to sleep cool in summer as warm in winter. An exhaust fan in your home will do the trick.

ARE you still trying to sleep in a hot-house this summer? You needn't. If you put a little heat of your own into installing an attic fan, you'll soon be cool.

During the day, the hot summer sun makes your attic a bake oven. The temperature may rise to 135°. This attic heat warms the entire house.

When night comes, outside temperatures drop 15° or 25°, and you find it pleasant to be in the yard. The walls and furniture in the house, however, retain heat far into the night, and the close, stuffy air makes sleep next to impossible.

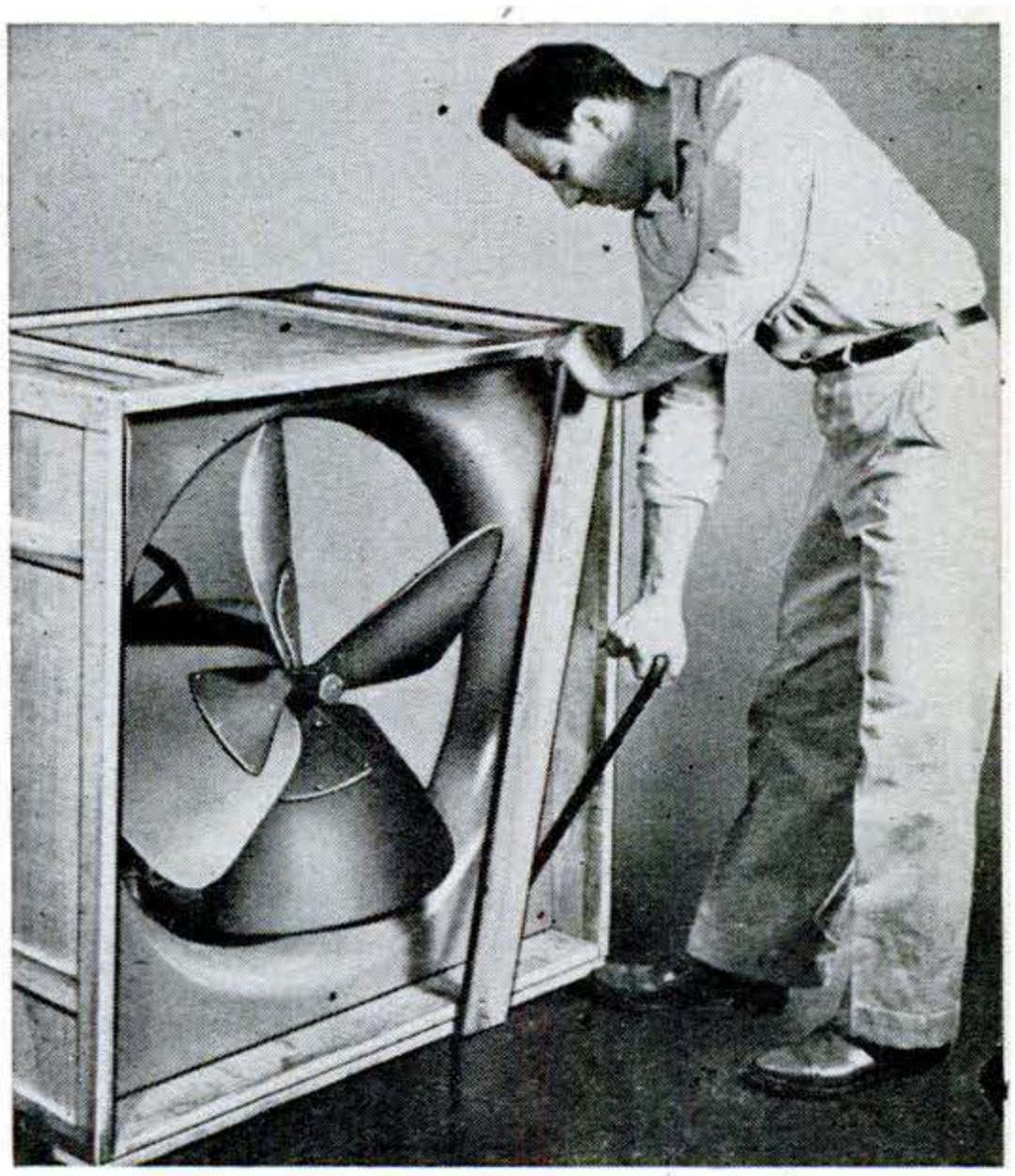
Properly installed, an attic exhaust fan takes care of this. It drives hot daytime air out of the attic through ventilating windows or louvers. Like a chimney, it sucks up air through the house. Cool night air sweeps in the windows. Soon you sleep as cool as if you were outside.

But don't expect an ordinary house fan to solve your problems. An exhaust fan must move a lot of air in a hurry.

In the southern states, it should change room air once each minute for proper cooling. Up North a complete air change once every two minutes is sufficient.

To determine the size of fan you need, figure the cubic content of your home. In the South this is the amount of air you will want it to exhaust each minute. If you live up North, divide the cubic content by two. A "certified rating" label on the fan you buy is assurance it will exhaust air at the rate the manufacturer claims.

How to install a typical fan is shown in the photos on this and the next page.



1. An attic fan must be big to move enough air to cool a home. This one is designed for installation in ceiling as seen in sketch above. **In** two-story house, upper hall ceiling is best.

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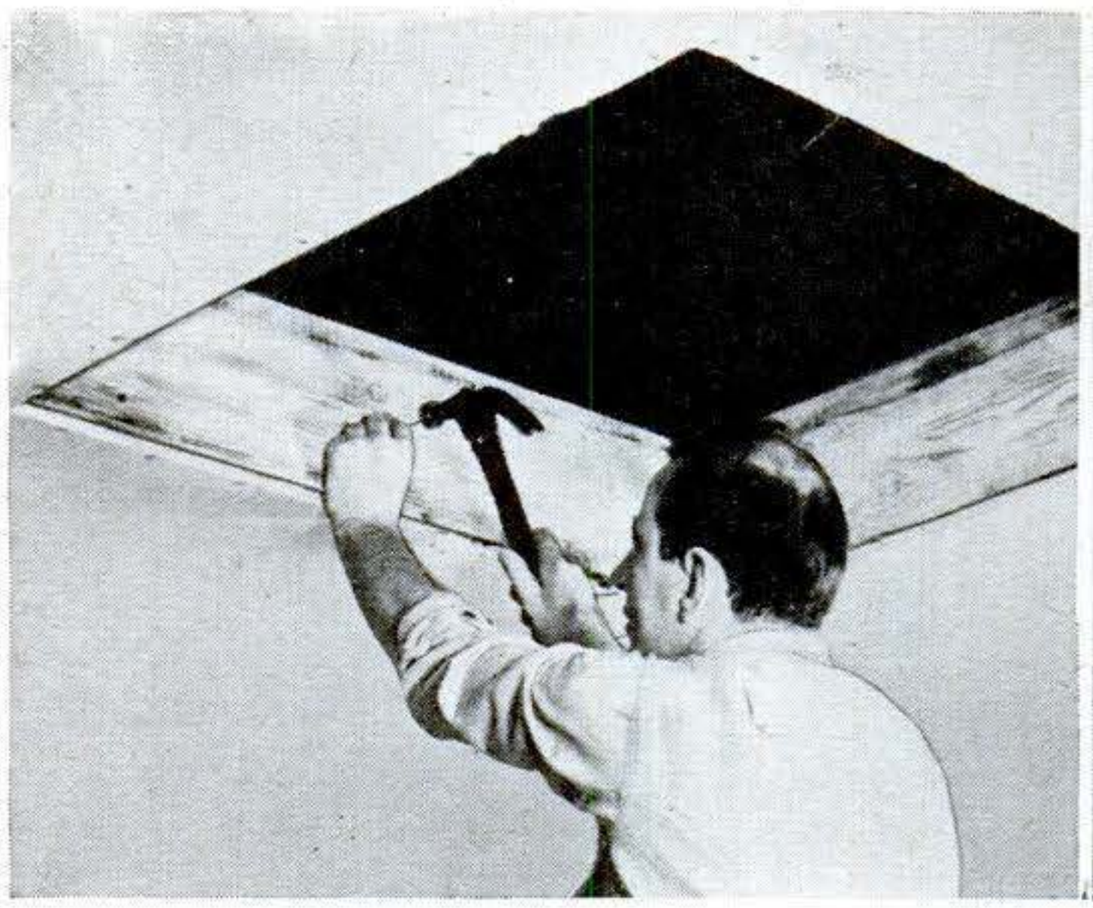
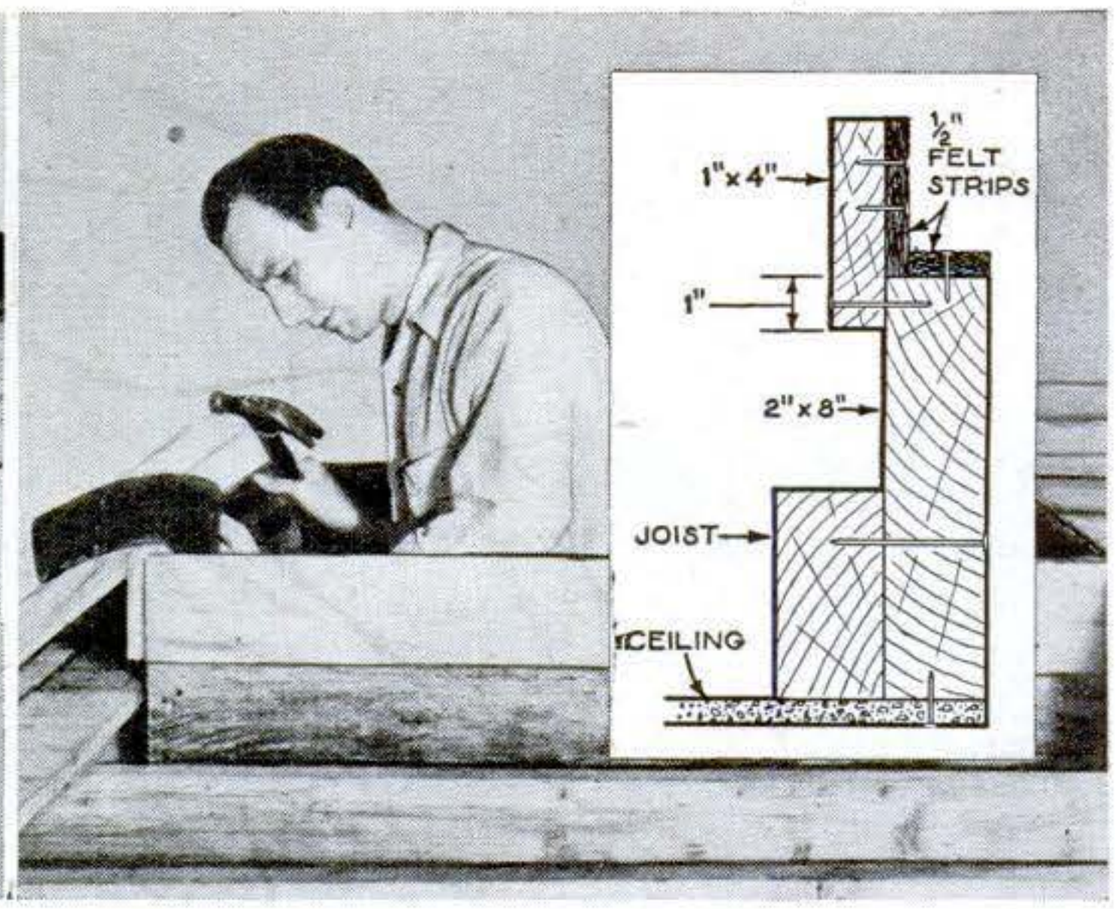
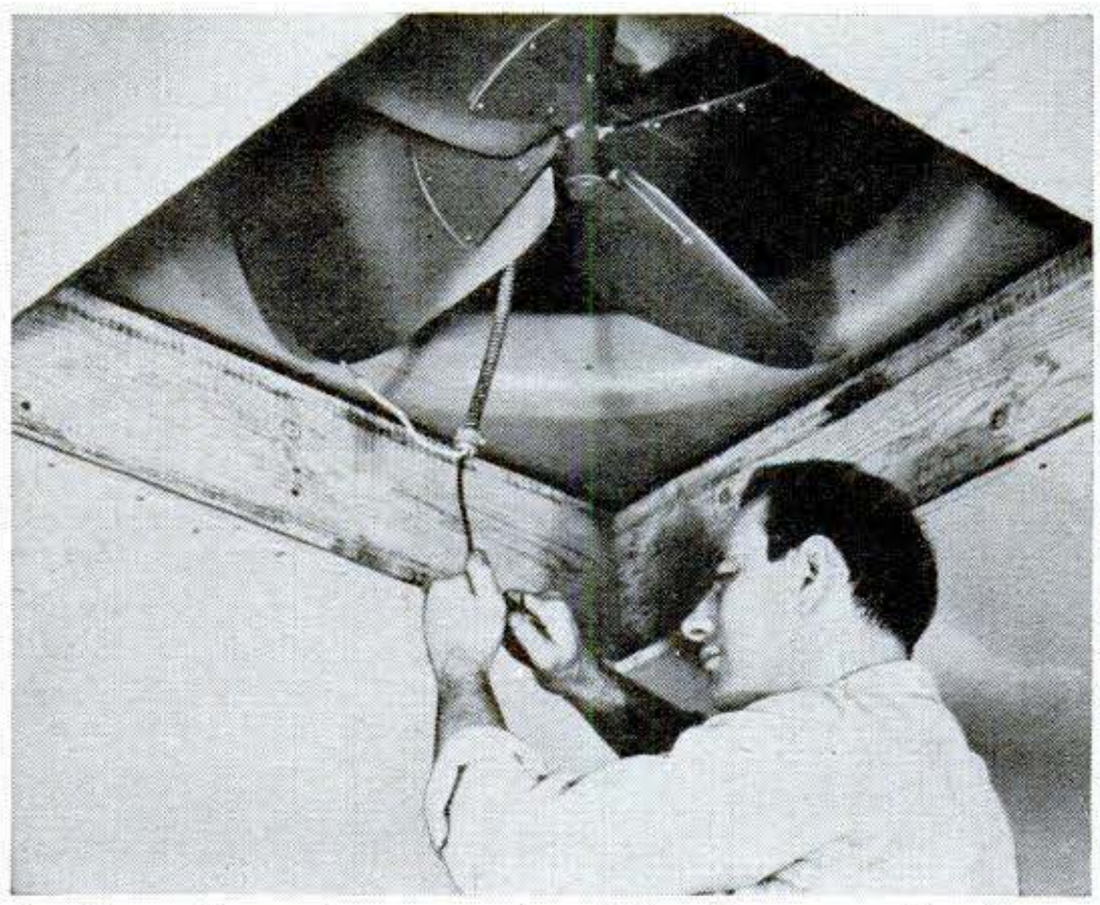


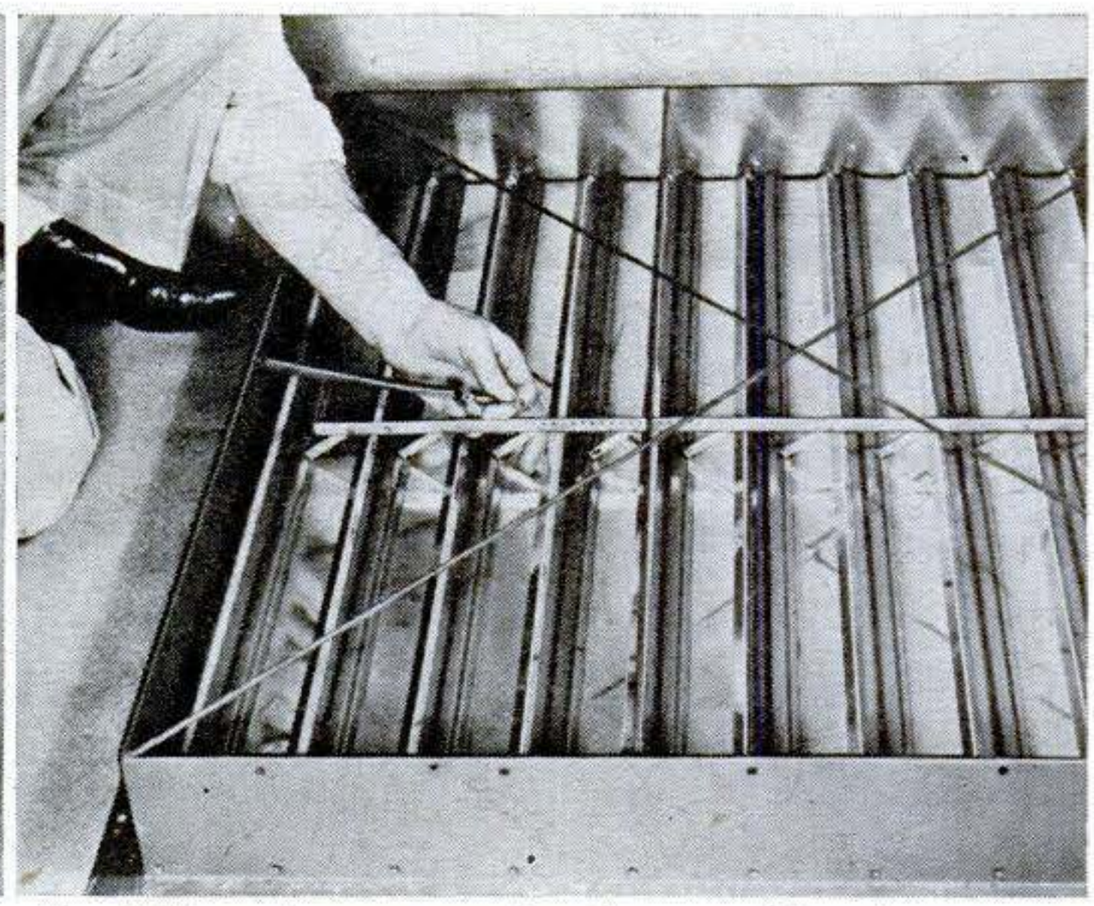
2. Cut square opening in ceiling and make a frame above it with two-by-eights. Make hole about 1½" smaller all around than fan plate. One or more ceiling joists may have to be cut.



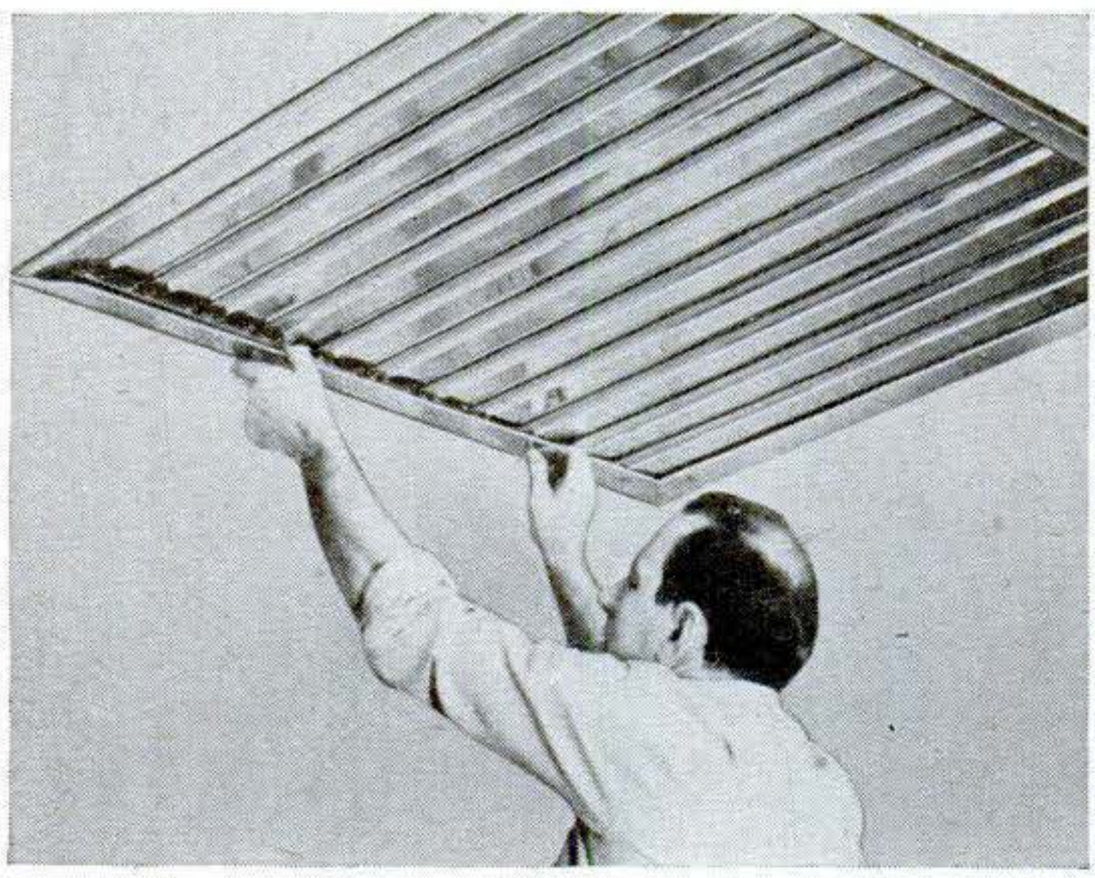
3. Nail 1" by 4" boards around outside of framed opening in attic, overlapping 1". Then tack strips of ½" felt inside the "L" formed by these boards and tops of two-by-eights.



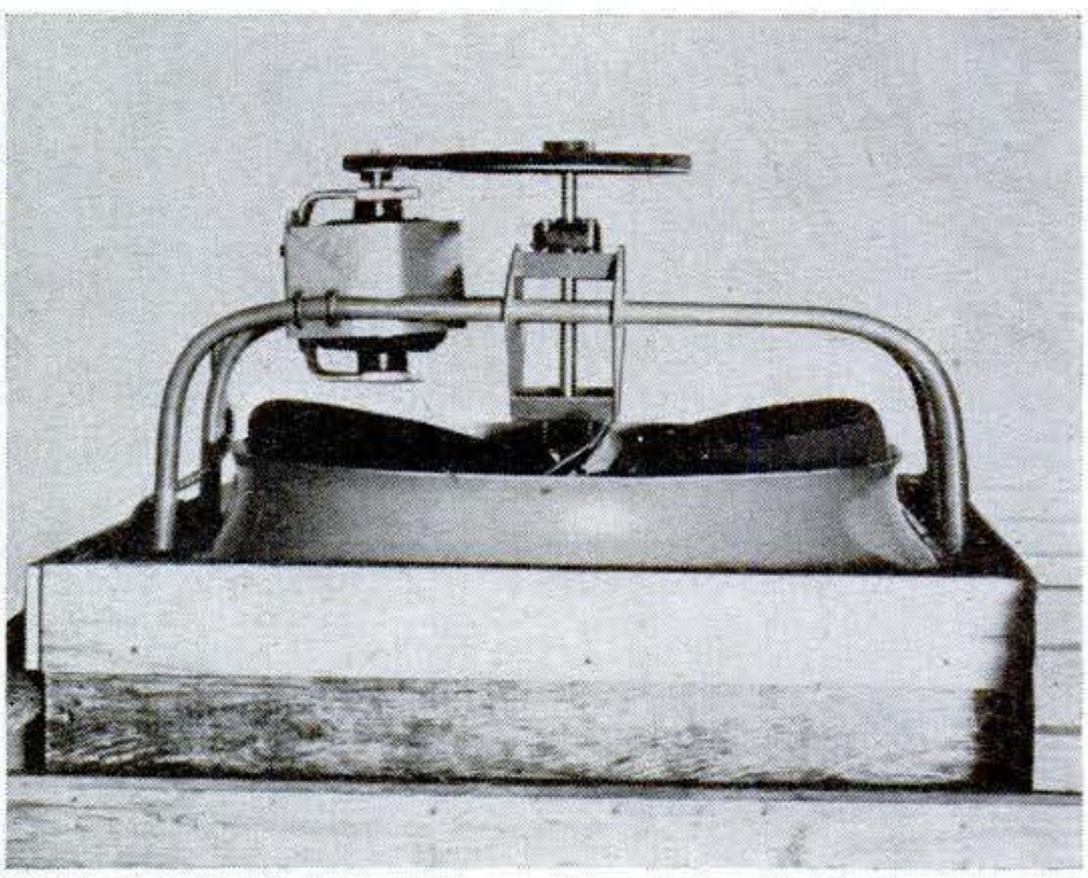
4. Rest fan plate on the felt after turning fan diagonally to raise it through the hole. Then locate the terminal box on underside of motor and connect the power line as shown here.



5. Adjust louver spring by attaching into proper hole on center connecting strip. This is to allow the louvers to close quietly. They are open only while the exhaust fan is running.



6. Fit louver into ceiling opening and attach with wood screws. Then put on polished aluminum strips as frame for louver. This molding fully covers edge of hole cut in ceiling.



7. Fan in attic is now ready to go. Fan shown has a three-point spring mounting to reduce vibration and noise. The boards around two-by-eights keep unit from shifting sideways.

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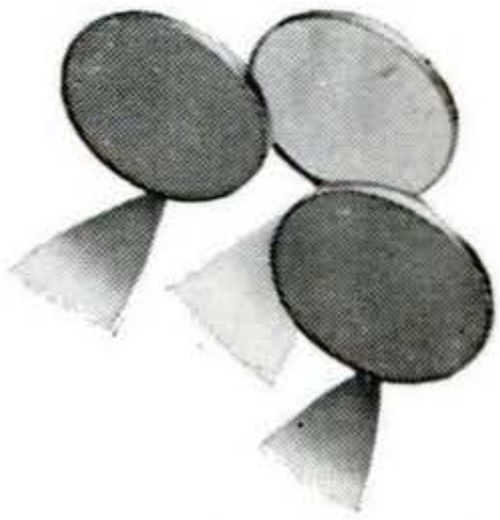
GET DRAMATIC SKIES WITHOUT CHANGING OTHER TONES

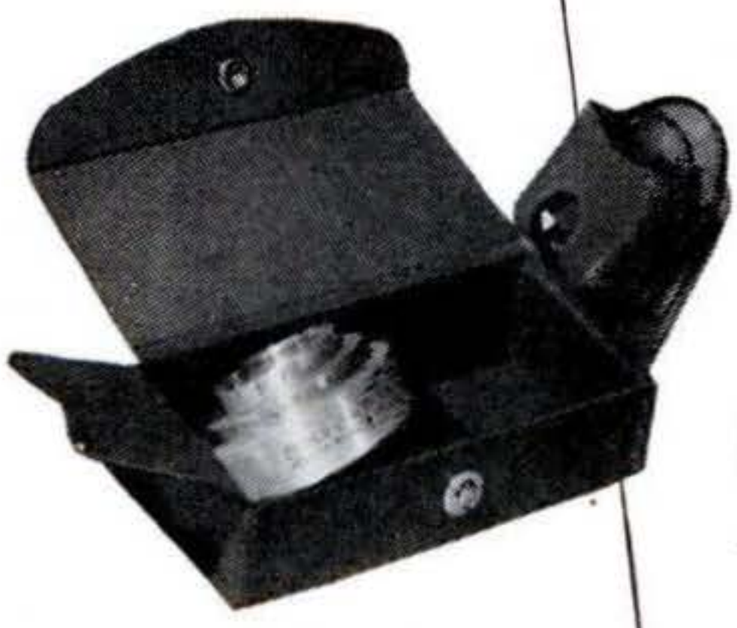
A Kodak Pola-Screen can change a vacation snapshot into a prize-winning photograph. Fit one on *your* camera. For color and black-and-white. Accessory Pola-Screen Viewer slips over handle—"previews" the varying sky tones you can obtain. Pola-Screens, from $6.50. Viewer, $6.50.



GIVE YOUR VACATION "SNAPS" THAT EXPERT TOUCH

KODAK FILTERS ADD LIFE . . . SPARKLE . . . EMPHASIS

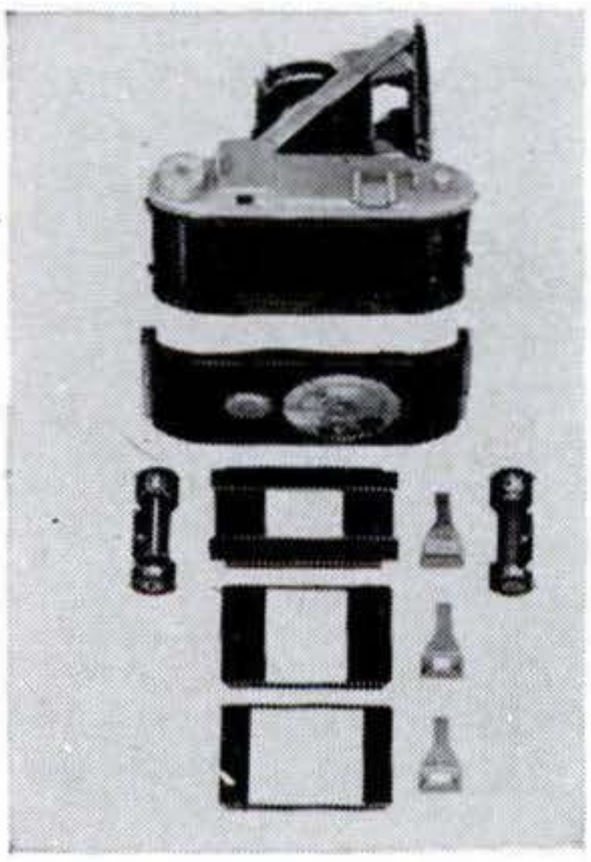
Kodak Wratten Filters utilize dyes of great purity, for accurately controlled light transmission. More than 100 varieties—such as *X1*, a green filter for natural flesh tones . . . *A*, a red for striking landscapes . . . *K2*, yellow, to emphasize clouds. And to warm up *color* shots, use a Kodak Skylight Filter for mountain and marine scenes and pictures taken in open shade. In series sizes, to fit most cameras, from $1.60.



KEEP YOUR FILTERS PROTECTED AND READY FOR ACTION

Kodak Combination Filter Case has two compartments. Kodak Adapter Ring, filter, and Lens Hood fit in one compartment—3 filters in the second. From $4.

ADAPTER KITS PERMIT KODAK TOURIST AND REFLEX CAMERAS TO USE KODACHROME FILM



The Kodak Tourist Adapter Kit, ($14.50 — left) for Tourist Cameras with *f*/4.5 and *f*/6.3 lenses, offers a variety of picture sizes—2¼ x 3¼; 2¼ x 2¼; 1⅝ x 2¼. Also adapts cameras for 2 x 2-inch Kodachrome slides. The Kodak 828 Adapter for Kodak Reflex Cameras ($5 — right) permits use of 828-size films, including Kodachrome. Each kit consists of back-frame masks, view-finder masks, and special spool baskets.

Prices are subject to change without notice and include Federal Tax where applicable

Be sure to see all these Kodak accessories at your Kodak dealer's

Kodak
TRADE-MARK

EASTMAN KODAK COMPANY, ROCHESTER 4, N. Y.

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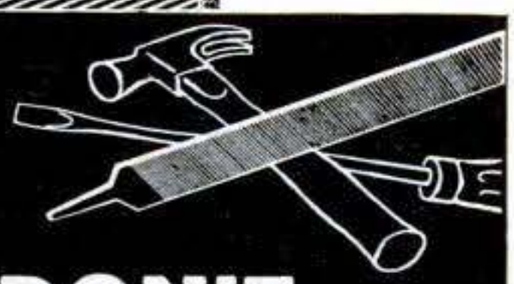
How to make files last longer

STEEL is the national security program's most essential material. Its conservation is everybody's concern —and duty. In files, steel can be either saved or wasted . . . saved, firstly, by buying *good* files (they consume no more steel than poorly made, short-lived ones); secondly, by proper use and care of files. Here are a few rules:

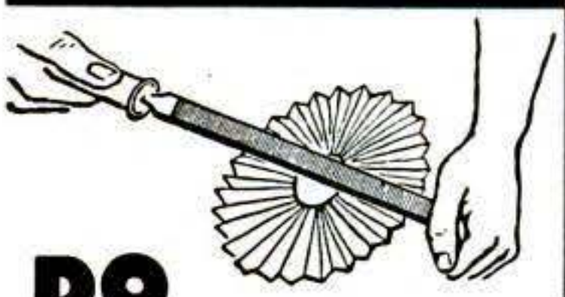


DON'T

throw files around carelessly—say, on top of one another. Scuffs, blunts, chips teeth.

DO

keep files clean—tap frequently on wood to loosen chips; also brush with file "card."



DO

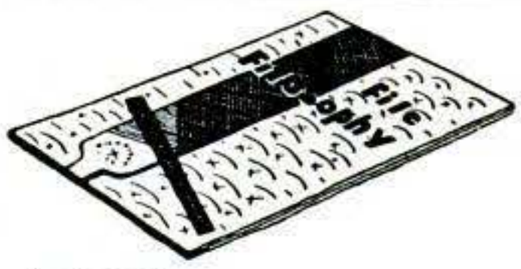
use The right file for the job. Different metals ruin wrong files.

DON'T

let files rust or fill up with dirt. Corrodes and dulls teeth.

DON'T

put heavy pressure on forward file stroke; nor "drag" file back under needless pressure.



DO

send for "File Filosophy"—best book on kinds, use and care of files you ever saw. FREE.

Using files properly is up to you. Making good files is up to us. There are none more carefully shaped, accurately cut, properly hardened—none longer-lasting than Nicholson and Black Diamond brands. The hardware dealer who sells them is reliable in helping you select the files you need.

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BLACK DIAMOND TRADE MARK

NICHOLSON FILES *FOR EVERY PURPOSE*

Gus Is Saved by a Straw

[*Continued from page 144*]

thorough check. But he also knew that his long years of experience had given him a pretty practiced eye at spotting troubles. Yet, he hadn't been able to find any.

"Would you like a sandwich or a piece of pie, Mr. Wilson," asked Jane. "I made it myself."

"That pie looks good to me," replied Gus as he started to get up.

Now There's Trouble With Straws

"Wait, I'll get it for you," said Jane. "I have to get up anyway to get another straw. This awful one has gotten soggy in the milk, and every time I suck in real hard it collapses."

"That's it!" Gus almost shouted.

Jane and Stan looked at the old garageman as if he were crazy. "That's what?" said Stan, puzzled.

"That's just what's wrong with the Bell's car," explained Gus, thumping his forehead with his knuckles. "What a chump I've been. It's just like that straw. Something's been stopping that engine from getting the air it's needed, and it's just naturally choked itself to death."

With that, he was on his feet and heading up the hill toward the parking area. Stan got up and followed, leaving Jane, with a half-nibbled chicken wing poised in midair, wondering if all men were like garagemen.

"What's your hunch?" Stan asked when they got to the Bell's car.

Without answering, Gus reached in under the hood of the car and began removing the air cleaner. "Now," he said, finally lifting the air cleaner out and placing it on the ground, "get in there and start her up."

Stan complied and Gus moved the throttle rod on the carburetor back and forth. To their surprise, the engine ran smoothly even when it was wide open. There wasn't the slightest hint of a cough or a miss.

It's the Cleaner All Right

"Clogged cleaner?" Stan asked, as Gus picked up the cleaner and began loosening the wing nut that held the top in place.

The steel-wool filter looked clean enough to Stan, but Gus had spotted something else. "Look here, Stan," he said, holding up the top of the cleaner.

Stan saw nothing particularly out of

[*Continued on page 196*]

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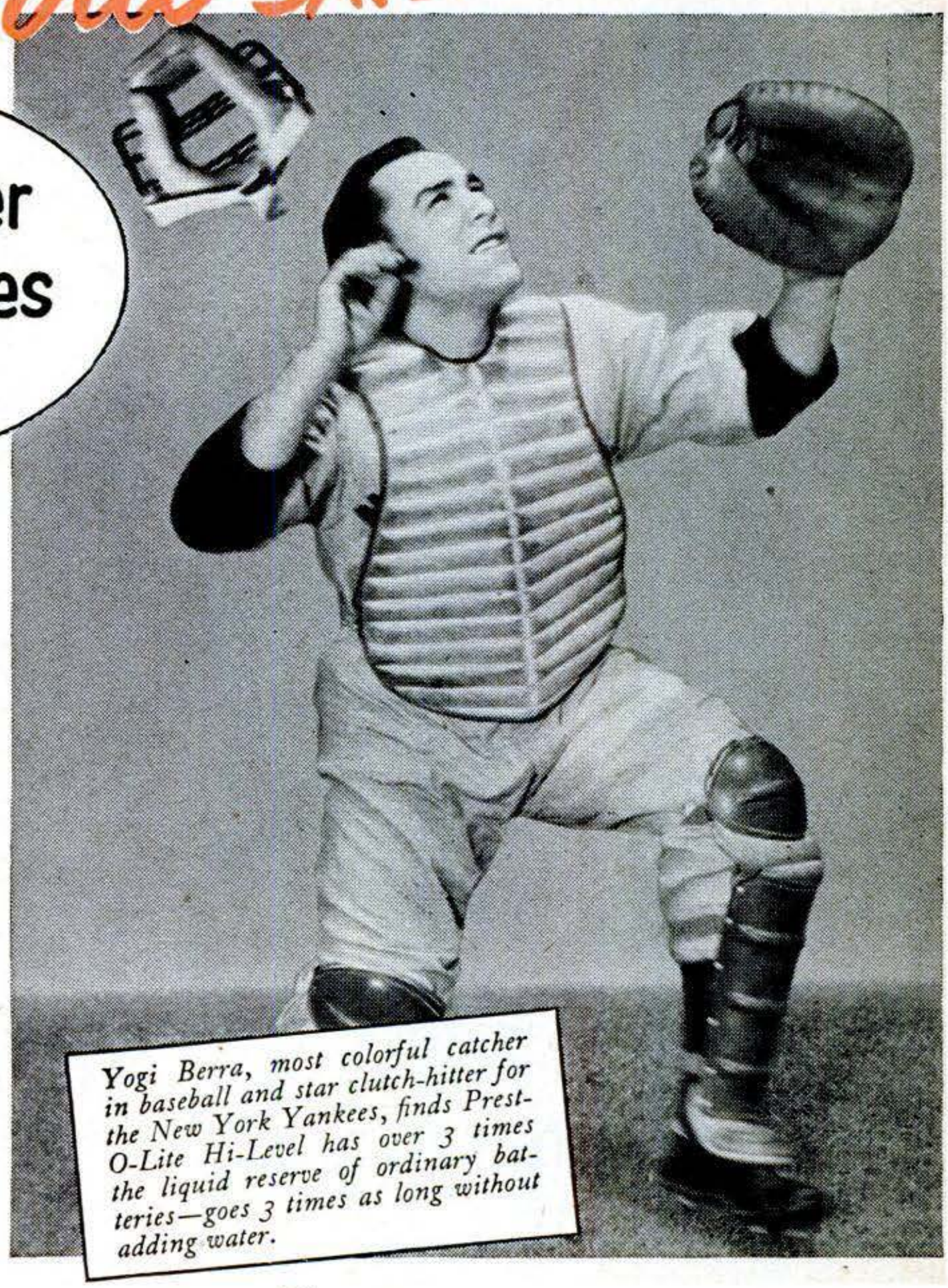
Yogi Berra SAYS

"I add water only 3 times a year"

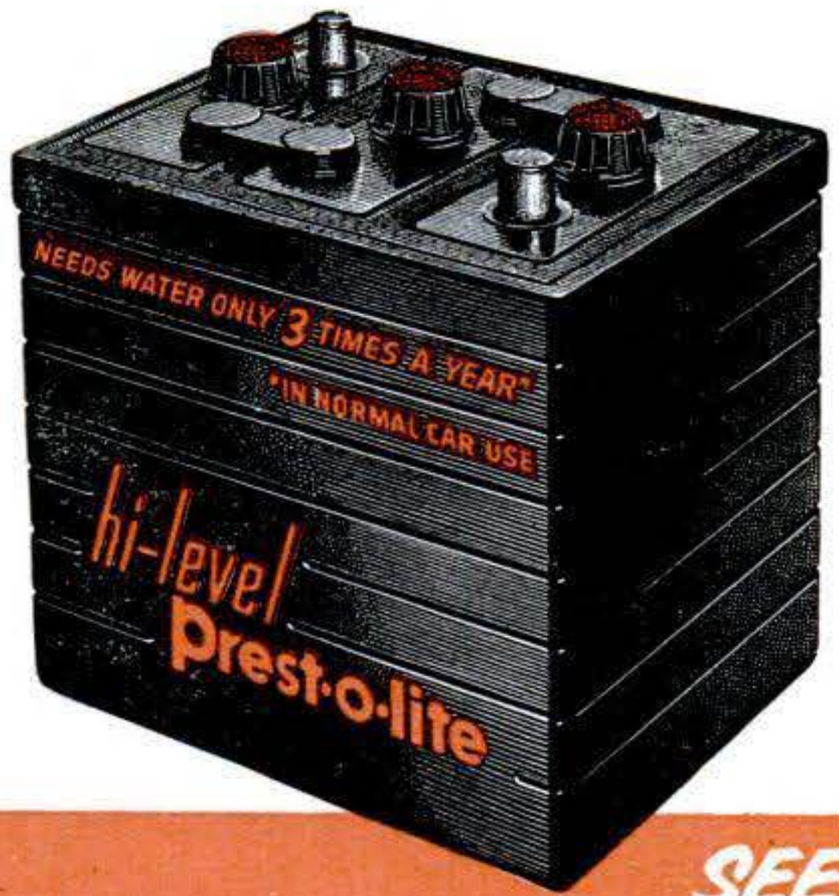


Yogi Berra, most colorful catcher in baseball and star clutch-hitter for the New York Yankees, finds Prest-O-Lite Hi-Level has over 3 times the liquid reserve of ordinary batteries—goes 3 times as long without adding water.

PREST-O-LITE HI-LEVEL BATTERY...

needs water only 3 times a year

IN NORMAL CAR USE



INSTALL a Prest-O-Lite Hi-Level Battery in your car and enjoy the comfort and convenience of this new principle of battery design. The Hi-Level Battery needs water only 3 times a year in normal car use and because of its advanced engineering design, it lasts longer, in tests conducted according to accepted life cycle standards. For quick starts and dependable service, see your Prest-O-Lite Dealer.

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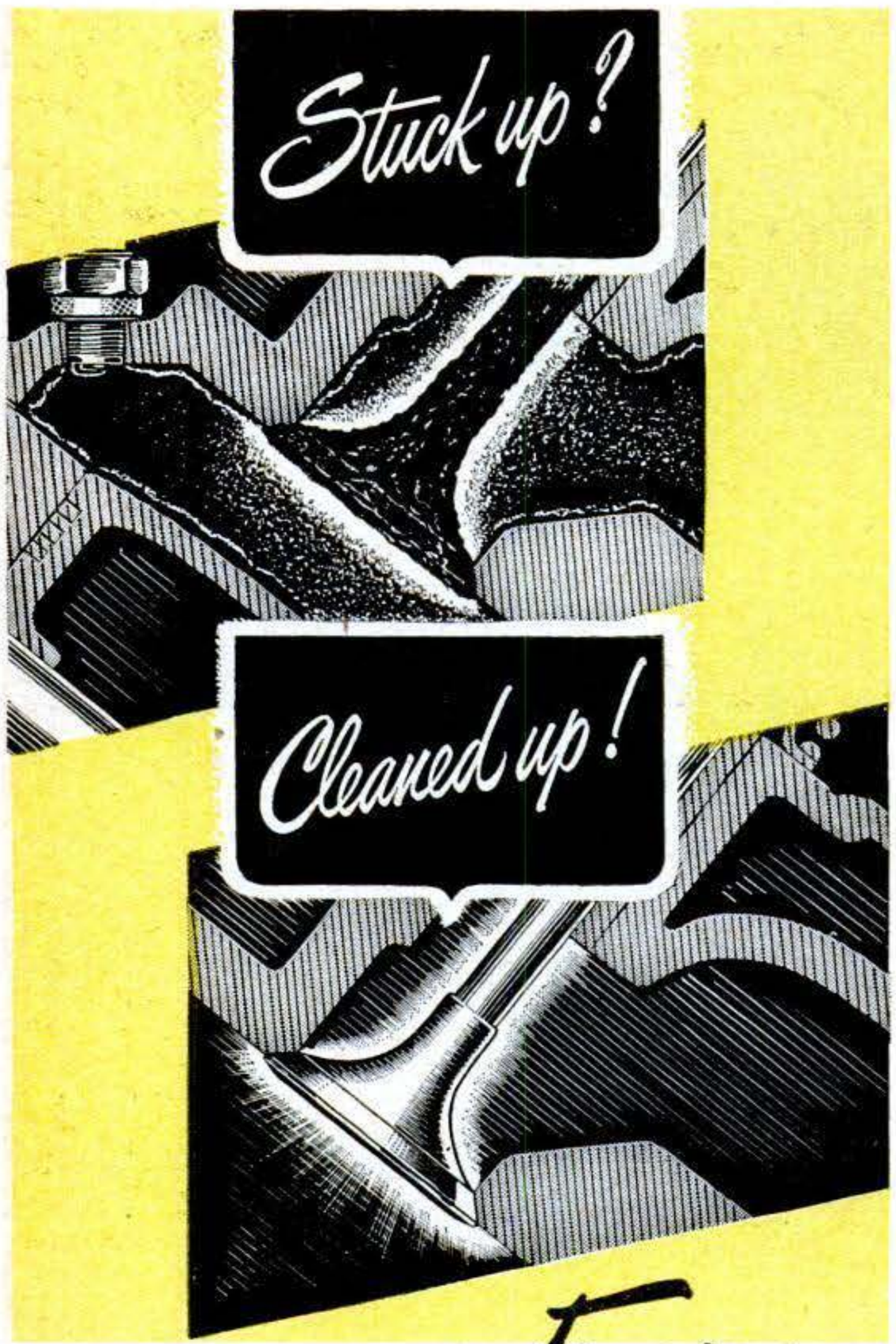

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Get rid of engine coughs, jerks, roughness. Chances are, it's caused by sluggish or sticky valves.

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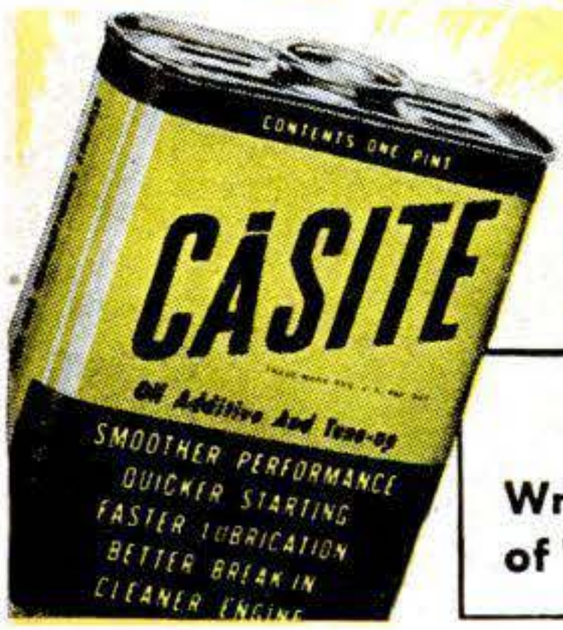
Get Casite for your car today—from your garage, service station or car-dealer. You get Better and Smoother Motor Performance or Double-Your-Money-Back.



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FREE!
Write for your free copy of "Facts of Engine Life."

Gus Is Saved by a Straw

[Continued from page 194]

the ordinary until Gus poked his screwdriver at a felt pad inside the top. It was supposed to be cemented to the metal, but about half of it had come loose.

Cleaner's Trouble Like Straw's

"This thing's been acting like a regular flap valve," pointed out Gus. "When Bell speeded up to pass that car, the rush of air through the cleaner was fast enough to suck this corner of the pad down over the intake to the carburetor. It choked off the engine like Jane's collapsing straw. At slow speeds, or when the engine wasn't pulling a load, there wasn't enough suction to pull it down."

Gus pulled the pad loose and threw it on the ground. "That little piece of felt could have cost the Bells their lives, and maybe others, too."

At that point, Jane appeared, carrying the red-checked tablecloth and the hastily packed up remnants of the half-eaten meal. "I guess the picnic's over," she said glumly.

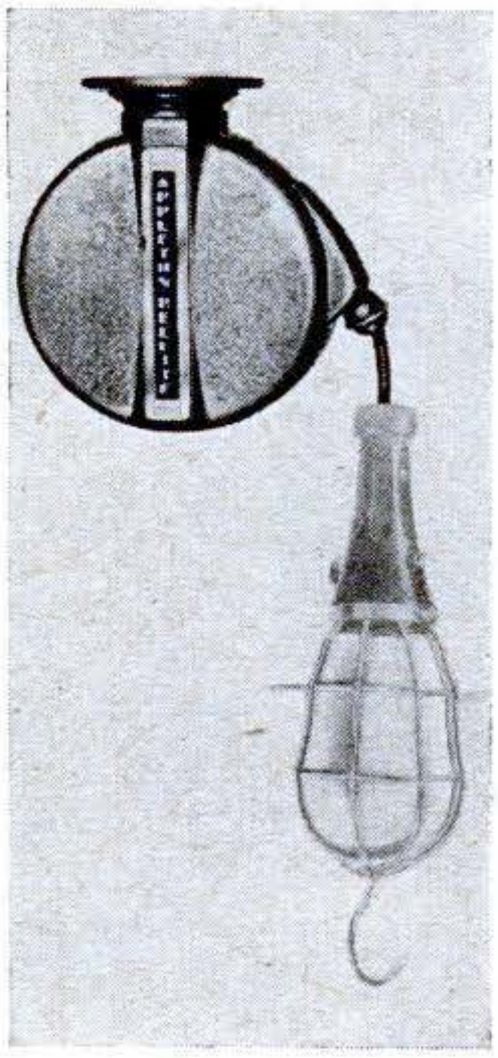
Next Problem: Fish

"Not at all," smiled Gus. "It's just begun. Jane, if you hadn't mentioned that straw, we might have been here all day fooling with the blamed car. I guess this makes us even for your holding us up this morning."

"Oh," said Jane innocently, "did I keep you waiting?"

Gus grabbed his fishpole and strode off toward the water, with a wince you could see on the back of his neck. END

Automatic Reel for Extension Cord



HERE'S a reel that automatically pays out and retracts up to 25 feet of extension cord for handy use in the home or shop. Installed on a four-inch overhead outlet box, the Reelite has an automatic stop action that holds the cord at the exact length wanted. The reel and its cord are protected by a steel case. Appleton Electric Co., Chicago, makes it.

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Wilbur Shaw says . . .

"It's hard to describe this new Chrysler without going off the deep end!"

Here's why America's most famous driver picked Chrysler to pace the 1951 Indianapolis 500 Mile Race . . . as recorded on tape during his first drive in our beautiful new car.

"It's a whale of an automobile . . . the most powerful—and probably one of the fastest stock sedans manufactured in the U. S."

"It's pretty hard to describe this car without going off the deep end!"

"This engine . . . (the revolutionary new 180-horsepower Chrysler FirePower Engine) . . . I can't get over the amount of power and snap . . .!"

"As astonishing as the performance of this engine is, it's only half the story! The rest is power steering . . . (Hydraguide, an exciting new Chrysler first) . . . the first on any U. S. passenger automobile, and a new Chrysler Fluid-Torque Drive."

"This steering combined with the automatic transmission . . . is the nearest thing to an automatic pilot for a car I can imagine."

"That makes a lot of automobile in one package . . . In fact, I think so much of this car that I've selected it as the pace car in the 1951 Indianapolis 500 Mile Race."

★ ★ ★

Remember . . . the above words are Wilbur Shaw's own, reported on a tape recorder in the car. Your own reactions will be equally enthusiastic. With the revolutionary new FirePower Engine—with Hydraguide, the first power steering in a passenger car—with Oriflow Shock Absorbers that double your comfort on rough roads—Chrysler brings you the most thrilling developments in the automobile in many years. Your nearby dealer will be happy to let you feel these new thrills for yourself.

Mr. Shaw's comments are reprinted through the courtesy of POPULAR SCIENCE Magazine.

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The Mark of Superiority

How to Take Prize Winning Pictures

[Continued from page 170]

A perfect print, in his opinion, is one in which there is a perfect range of tones from pitch-black areas among the darker shadows, through the middle tones, to the highlights, which should have some detail. Chalky-white areas are uninteresting highlights.

Bodine's print-developing time is much longer than that used by many photographers, sometimes up to 7 or 8 minutes. The majority of prints he has examined, as judge and contestant, have been underdeveloped. Here, he believes, is why:

A photographer gives a print a 30-second exposure and pulls it out of the developer after a minute or so. At first glance, it can be seen that the print is too light.

The photographer then increases his exposure to about 45 seconds and again develops a minute or so. This result is still far from what the photographer can accomplish on the print, but it looks so much better than the first that he believes he has hit the perfect processing combination.

As an experiment, Bodine suggests going back to the original 30-second exposure, and then developing two or three, or maybe four or five minutes. This may give startling results—deep, rich blacks, brilliant highlights, and a general illumination that almost creates a third-dimensional effect.

The exposure and development times mentioned here are, of course, arbitrary. Actually those times will vary with a great many things, including the type of enlarger.

The contestant who tones his work gives himself added advantages, Bodine believes, for toning adds snap and brilliancy, and often permanency, to a print. Any color helps. Bodine prefers blue-gold toning, using the following formula:

Fifty grains Mallinckrodt thiourea (thiocarbamide), 10 oz. water; 50 grains Mallinckrodt citric acid, 10 oz. water; 15 grains Mallinckrodt gold chloride, 10 oz. water. Then take one ounce of each of these stock solutions and add sufficient water to make 32 ounces of toner. Heat to 115° F. and use with chloro-bromide papers.

He develops his exhibition prints in Selectol or Dektol developers, depending upon the snap and contrast he wants. He uses the same full exposures and development time for both glossy and textured prints.

[Continued on page 200]

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SINCLAIR RESEARCH LABORATORIES—nine buildings containing the most modern testing equipment known—have contributed many of today's most important developments in petroleum. Under the Sinclair Plan, a part of these great laboratories will work on the promising ideas of inventors everywhere.

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The SINCLAIR PLAN will open up the Company's great laboratories to every American who has an idea for a better petroleum product

A ROAD BLOCK stands in the path of American inventiveness today—it is the need for large and expensive laboratory facilities in developing and proving out new ideas.

This was no obstacle in our earlier days. Eli Whitney built his cotton gin with homemade tools in a barnyard. In contrast, the recent development of nylon took ten years of research time and 70 millions of dollars.

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To break down this road block to outside invention within the petroleum field, we offer the Sinclair Plan.

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If the directors of the laboratories select your idea for development, they will make, in most cases, a very simple deal with you: In return for the laboratories' investment of time, facilities, money and personnel, Sinclair will receive the privilege of using the idea free from royalties. This in no way hinders the inventor from selling his idea to other companies or from making any kind of arrangements he wishes without further reference to Sinclair.

How to Participate

Instructions on how and where to submit ideas under the Sinclair Plan are contained in a complete Inventor's Booklet that is available on request. Write to the office of the Executive Vice-President, Sinclair Research Laboratories, Inc., 630 Fifth Avenue, New York 20, N. Y. for your copy of this booklet.

IMPORTANT: *Please do not send in any ideas until you have sent for and received the booklet of instructions.*

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How to Take Prize Winning Pictures

[Continued from page 198]

When processing a print that is to be toned, he advises, bear in mind that blue toning with gold intensifies the print about 25 percent. If the picture is to be toned in brown, and selenium toner is used, the print will intensify about 10 to 15 percent. The latter toner, incidentally, works well only on bromide papers. The other one works well consistently only on chloride or chloro-bromide papers. For a unique direct toner, he suggests mixing old developer with fresh developer of the same formula.

For night pictures, Bodine has developed a special technique. "Go after night pictures," he says, "in bad weather. Just after a rain is ideal, for then you can make a play on reflections in the wet streets.

"Avoid the clean, moonlight nights, because there is nothing actinic about them. It is in the bad weather that the clouds and the mists hang low, reflecting your light back and outlining your subjects for you.

"Night shots of buildings are more interesting if shot in the early evening before office lights have been turned off."

This technique calls for special negative developing. "Use your softest film formula," Bodine advises, "but add only a fourth the usual amount of carbonate. If one ounce is called for, use only one-quarter ounce in a few ounces of water. Develop the negative 20 to 25 minutes. Now, in the dark, add another quarter-measure of carbonate, develop a few minutes more, and fix the film."

Negatives processed in this manner will look awful, the photographer says, but will print magnificently, with an amazing amount of shadow detail and highlight quality.

When an exhibition print is printed and dried, remove pinhole spots with a sharp etching knife. Cover up the white spots with water color. Finally, apply a coat of wax, varnish, or some print-luster solution. Many print-luster solutions that are too thick can be thinned down with turpentine for a neater-looking job. It is a small detail but an important one, Bodine says, to get the best possible finish on a print. Many also-ran contestants skip the process.

Bodine is asked frequently if it is good chemistry or fine art that contributes most to salon photography. And which should an amateur study? Bodine favors art. A photographer can learn chemistry, he says, from the labels on his chemicals. END

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MADE RIGHT for Fords, Genuine Ford Parts, like this muffler, are specified by wise motorists to save time, money and trouble. They're *right* because they're duplicates of the parts in your Ford—they keep Fords *all Ford.*

FIT RIGHT in your Ford—a "must" for important parts like the Genuine Ford Carburetor above. It's typical of the parts designed by Ford engineers, to work right in your Ford . . . to keep your Ford young longer.

LAST LONGER in Fords. This sign is displayed wherever Genuine Ford Parts are sold . . . at all Ford Dealers and selected independent garages. Specify Genuine Ford Parts . . . made right . . . to fit right . . . to last longer.

KEEP YOUR FORD ALL FORD!

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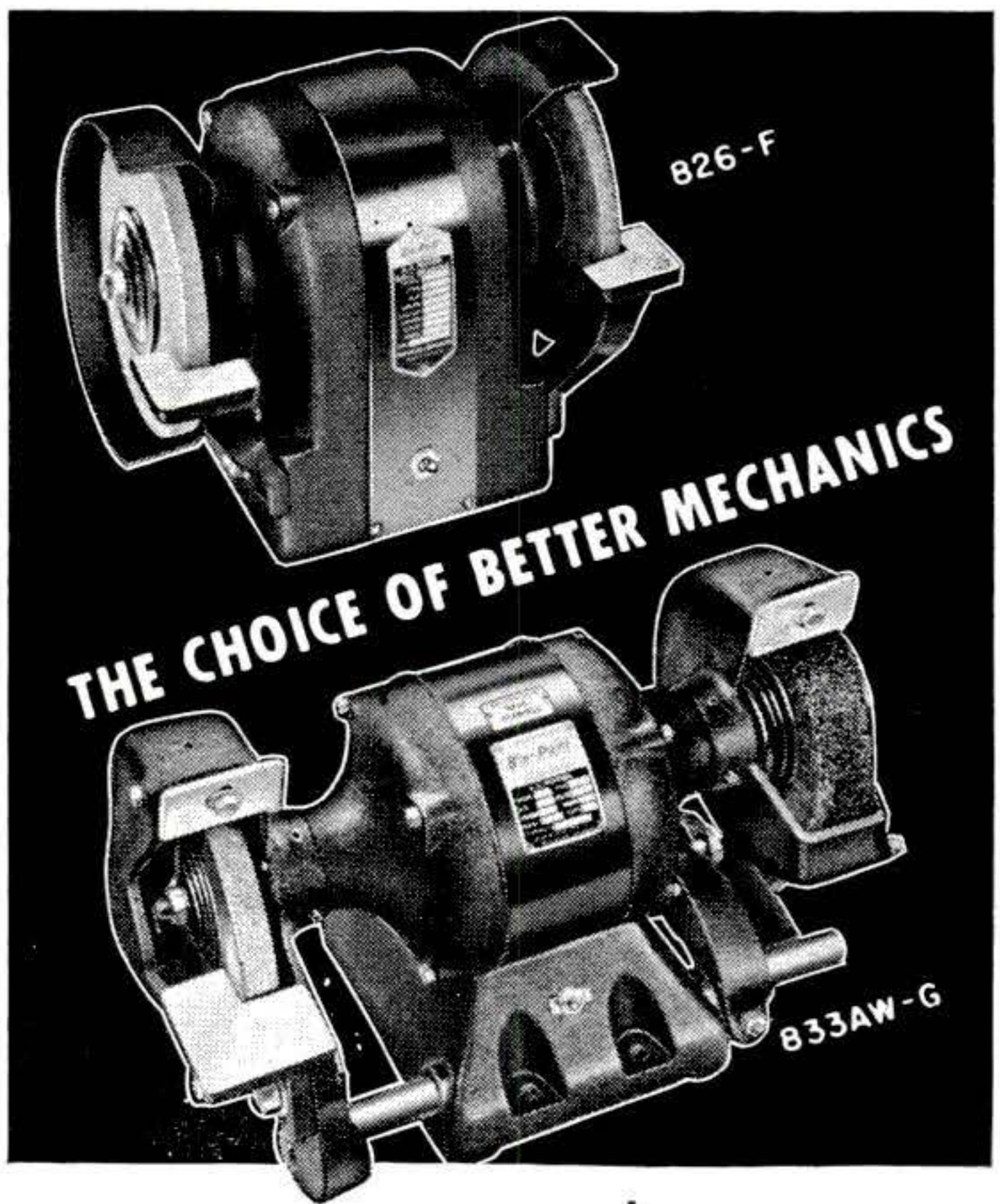
Snap-on* Blue-Point BENCH GRINDERS



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How the Stars Are Born

[Continued from page 80]

such a disk would be what mathematicians call gravitationally unstable. That is to say, the attractive forces of gravitation would exaggerate any irregularities that were present in it at the beginning. From this it can be shown that the gas would be bound to break up into a large number of separate irregular clouds. Although the clouds are very big when judged by ordinary standards they are still much smaller than the diameter of the Galaxy.

Condensed Clouds Become Stars

Once clouds have condensed like this, gravitation again exaggerates all the small initial irregularities that they happen to contain. So further condensation would take place in each cloud. At this point it is only necessary to say "and so on," for *by repeating the condensation process* a sufficient number of times, *we must eventually arrive at the particularly dense sort of condensation that we call a star.* Compared with the gas clouds a star is a body of very small dimensions.

As a condensation shrinks, its internal temperature rises, and when this becomes sufficiently high, *energy begins to be generated in the interior. This is because a process of atomic transmutation is started up.* A stage is eventually reached when the energy so generated is adequate to balance the radiation escaping from the surface of the star. Contraction then ceases and the body becomes a normal star like the Sun.

Tunnels in the Dust

Owing to the ripples and eddies that are constantly present in the interstellar gas the star soon finds itself moving through the gas. But any such relative motion between star and gas is small compared with their common motion around the Galaxy. Instead of the star rushing through the gas, it drifts through.

The situation is similar to one person overtaking another in the corridor of a train. There is a relative motion between them, but this is usually small compared with the speed of the train.

As it drifts like this through the interstellar gas a star tends to pick up more of it. The rate at which it attracts the gas and the way it picks it up can be studied mathematically. It turns out that the gravita-

[Continued on page 204]

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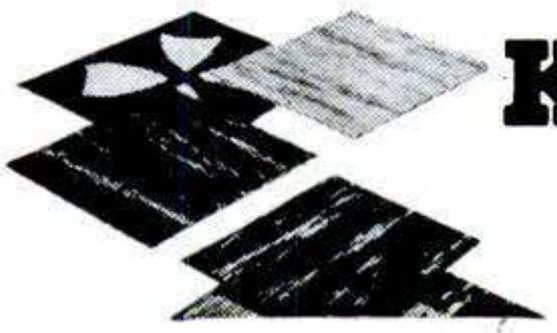
To find out just what it will cost you to lay a Kentile Floor in any room of your house, consult your Kentile Dealer. He's listed under FLOORING in your classified phone directory.

**Price quoted is for a 8' x 9' kitchen. Your floor may cost considerably less or slightly more depending on the colors you choose and the size of your room.*



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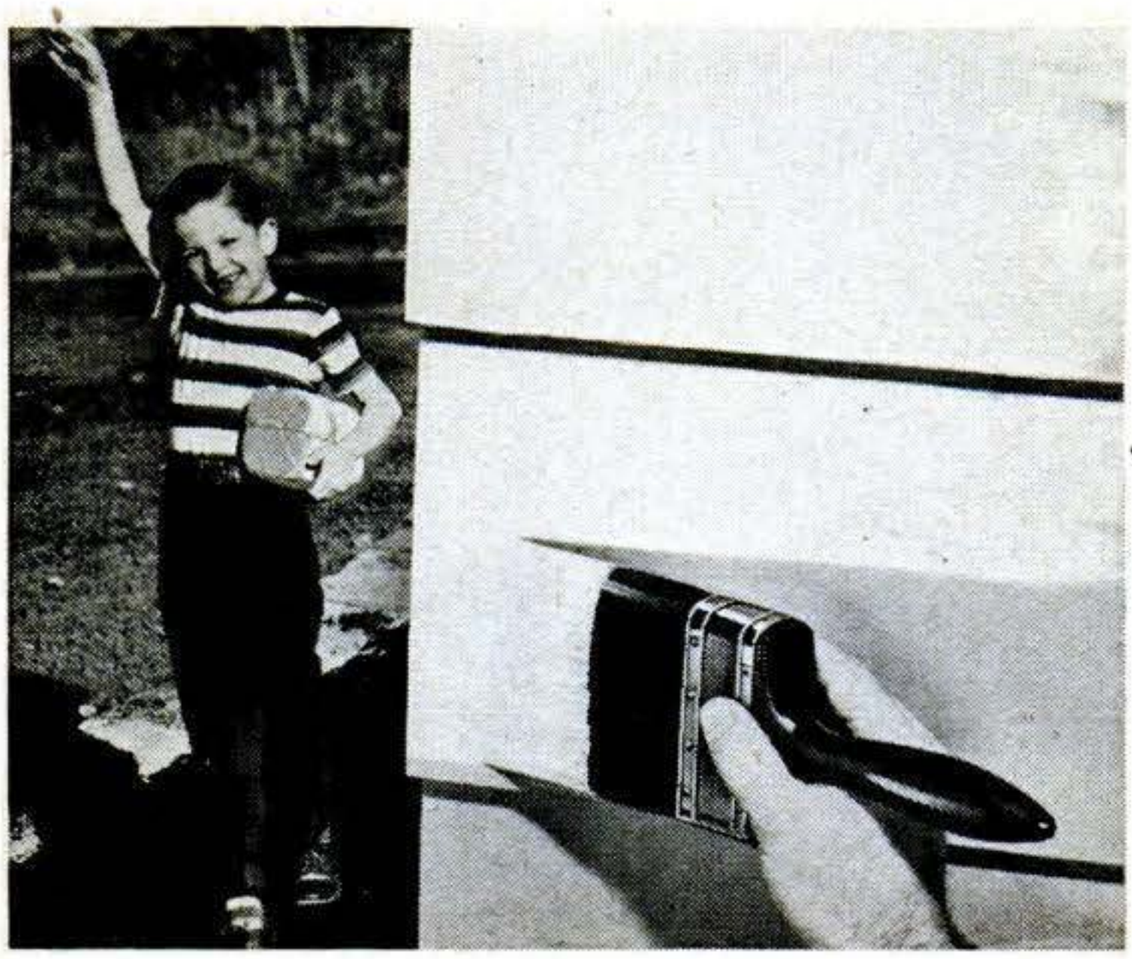
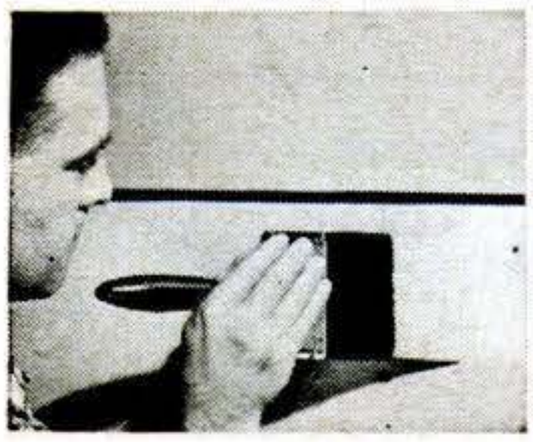
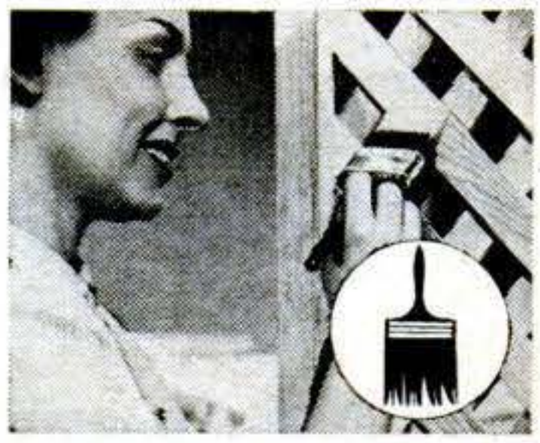
POINTERS FOR HOME PAINTERS



How you can get smoother painting ... longer life from your brushes



In painting wood surfaces, work with the grain and paint last strokes of each brushful back into the portion of surface previously coated.



Painting edgewise on narrow surfaces with large brush causes "fingering" (inset), ruins brush. Use small brush, one designed for the job.

For overnight cleaning, pour thinner on brush and work out paint on newspaper. Then use stick or paint scraper to squeeze out paint, suspend brush in thinner.

For storage, clean brush thoroughly with thinner, then scrub bristles with warm water and cleanser. Rinse in clear water, comb bristles and wrap in paper and store.

For best results use NYLON PAINT BRUSHES

Job after job, you'll get best results with a nylon paint brush. Durable Du Pont nylon bristles don't break off, even on roughest surfaces. They last 3 to 5 times longer than ordinary bristles . . . paint smoother . . . are clean and sanitary. Nylon paint brushes are made by leading manufacturers in all types and sizes. Look for the word NYLON on the handle.

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DU PONT NYLON BRISTLES

[Continued from page 202]

tional field of the star pulls in gas from far and wide, and *as the star moves through the gas it sweeps up the material lying in a huge tunnel.*

The distance across the tunnel is enormously greater than the size of the star. The exact diameter of the tunnel depends on the speed of the star through the gas. The smaller the speed the broader the tunnel. So the slower the motion of the star through the gas, the more gas it picks up.

How Stars Grow Big

The tunneling process evidently increases the quantity of gas within the star. The star will not increase much unless its speed through the gas is exceptionally small, and by small I mean not more than 5,000 miles an hour. When the relative speed of star to gas is about 30,000 miles an hour, as it is for most stars, the tunnel is too thin for the changes to be appreciable, even over long time intervals.

Now there are very few big stars in the Galaxy. *Only about one star in a million is more than ten times as massive as the Sun.* I believe that these stars are just the ones that have had particularly low speeds through the gas during the last 100,000,000 years. Accordingly these stars have been drilling out extremely fat tunnels and have swept up tremendous quantities of interstellar gas, and that is why they are so big.

Stars Are Being Born Now

The Milky Way is all that we can see of a huge disk-shaped cloud of gas and stars that is turning in space like a great wheel. We referred to this cloud as our Galaxy. At one time our Galaxy was a whirling disk of gas with no stars in it. But then, out of the gas, clouds condensed, and then in each cloud further condensations were formed. It is by repetition of this that stars are eventually born, for the stars are simply dense condensations of gas.

Our Galaxy is still very much in its early youth. If instead of only getting a momentary peep at it, we could observe our Galaxy throughout two or three rotations, we should see that, so far from being a worn-out structure, *the Galaxy is really a scene of violent and never ceasing activity.* We should, in fact, see the dynamic picture that the New Cosmology presents to us.

[Continued on page 206]

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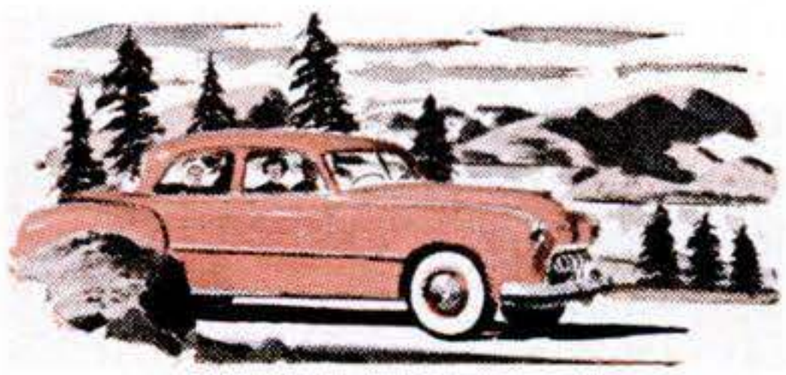

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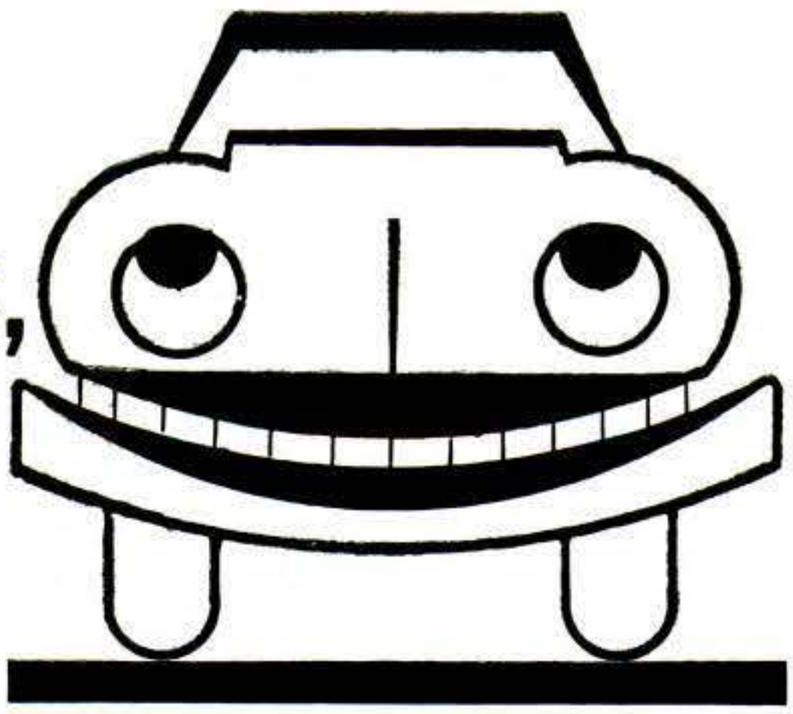

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"So when you hear me 'hum' inside, you know it's just my way of saying, Thanks, Mister for Pyroil —for adding miles to *your* car."

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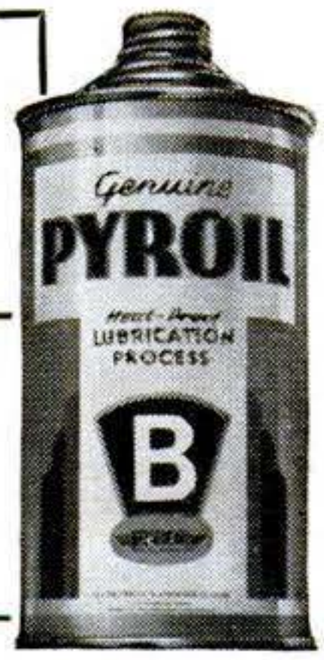

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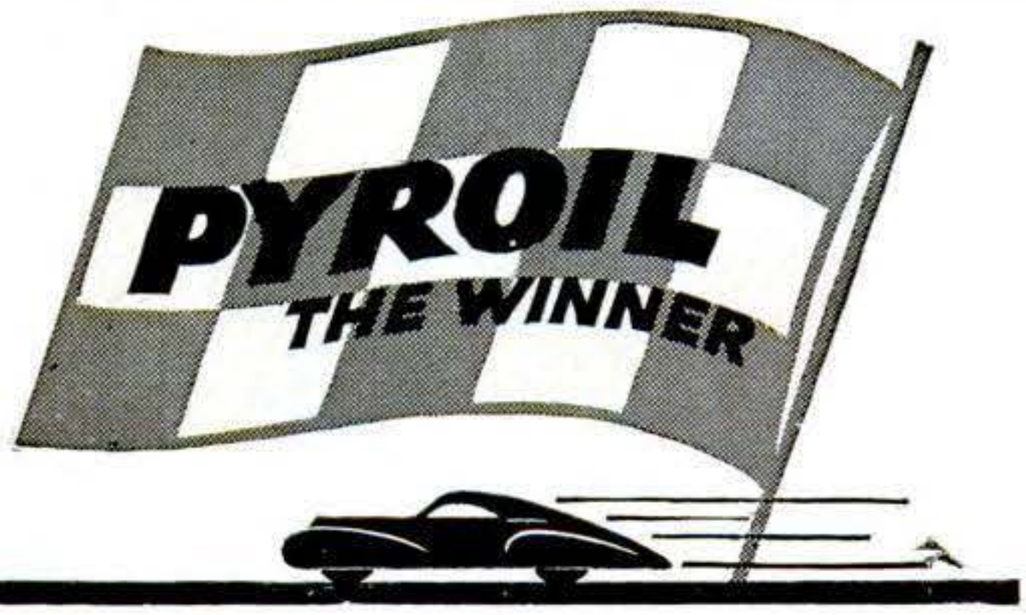

How the Stars Are Born

[Continued from page 204]

Although I think there is no doubt that every galaxy we observe to be receding from us will in about 10,000,000,000 years have passed entirely beyond the limit of vision of an observer in our Galaxy, yet I think that such an observer would still be able to see about the same number of galaxies as we do now. By this I mean that *new galaxies will have condensed out of the background material at just about the rate necessary to compensate for those that are being lost as a consequence of their passing beyond our observable universe.*

At first sight it might be thought that this could not go on indefinitely because the material forming the background would ultimately become exhausted. The reason why this is not so, is that new material appears to compensate for the background material that is constantly being condensed into galaxies. This is perhaps the most surprising of all the conceptions of the New Cosmology. For I find myself forced to assume that *the nature of the Universe requires continuous creation—the perpetual bringing into being of new background material.*

Out of the Nowhere

Where does the created material come from? It does not come from anywhere. Material simply appears—it is created. At one time the various atoms composing the material do not exist, and at a later time they do. This may seem a very strange idea and I agree that it is, but in science it does not matter how strange an idea may seem so long as it works.

To avoid the issue of creation it would be necessary for all the material of the Universe to be infinitely old, and this it cannot be for a very practical reason. For if this were so, there could be no hydrogen left in the Universe. Hydrogen is being steadily converted into helium throughout the Universe and this conversion is a one-way process—that is to say, hydrogen cannot be produced in any appreciable quantity through the breakdown of the other elements. How comes it then that the Universe consists almost entirely of hydrogen? If matter were infinitely old this would be quite impossible. So we see that the Universe being what it is, the creation issue simply cannot be dodged. And I think that of all the various possibilities that have been suggested, continuous creation is easily the most satisfactory. END

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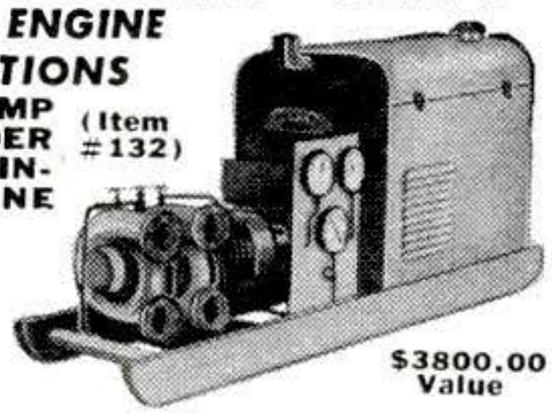

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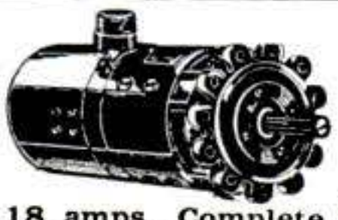

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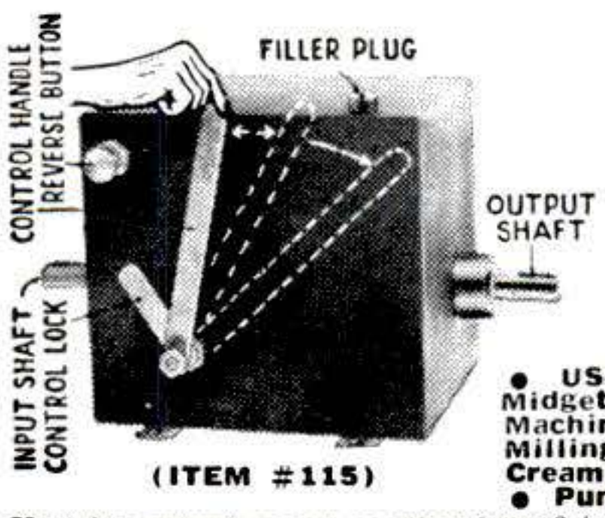

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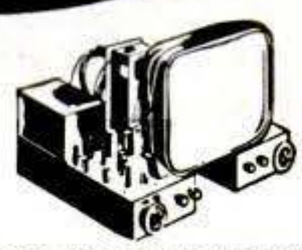

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[Continued from page 95]

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When war broke out in Korea last year, immediately claiming a large share of current blood collections, the search for a plasma substitute got top priority. Responsibility was assigned to dynamic Dr. M. C. Winternitz and his staff at the National Research Council—the nation's highest scientific authority. There were plenty of possibilities. Materials that had been tested at one time or another included algin (from seaweed), gum arabic, cattle serum, gelatin, and a sugar fermentation product known as Dextran—a Swedish discovery which has been used extensively in Sweden and England.

Today the search has narrowed to PVP, Dextran and gelatin as the best bets. But of all the possibilities, PVP is by far the most exciting to medical researchers, for in addition to its effectiveness as a plasma-substitute, it has other properties which promise revolutionary developments.

PVP Is War Baby

The story of PVP goes back to January 1940, in Germany. Dr. Helmut Weese, research director of the German Bayer company at Elberfeld, was called to a conference of the German Army's medical consultants.

Weese knew that there was neither enough time nor enough blood donors to set up a program for real plasma.

The one obvious place to look for such a substitute was the remarkably productive laboratory of Dr. J. Walter Reppe at the I. G. Farbenindustrie plant in Ludwigshafen. Reppe is a stubborn, independent thinker, with a contempt for "so-called facts from textbooks."

"Science has been greatly harmed," he says, "by those who try to experiment and then say 'It can't be done,' when all they really mean is 'I couldn't do it.'"

Among the things that couldn't be done, according to all the laws of chemistry, was to put the fantastically unstable and highly explosive gas, acetylene, under pressure, or expose it to copper. Reppe did both. Destroying only a portion of his laboratory in his first attempts, he finally succeeded in holding acetylene under a pressure 20 times as great as ever before had been attained. From the reactions thus made possible, add-

[Continued on page 210]

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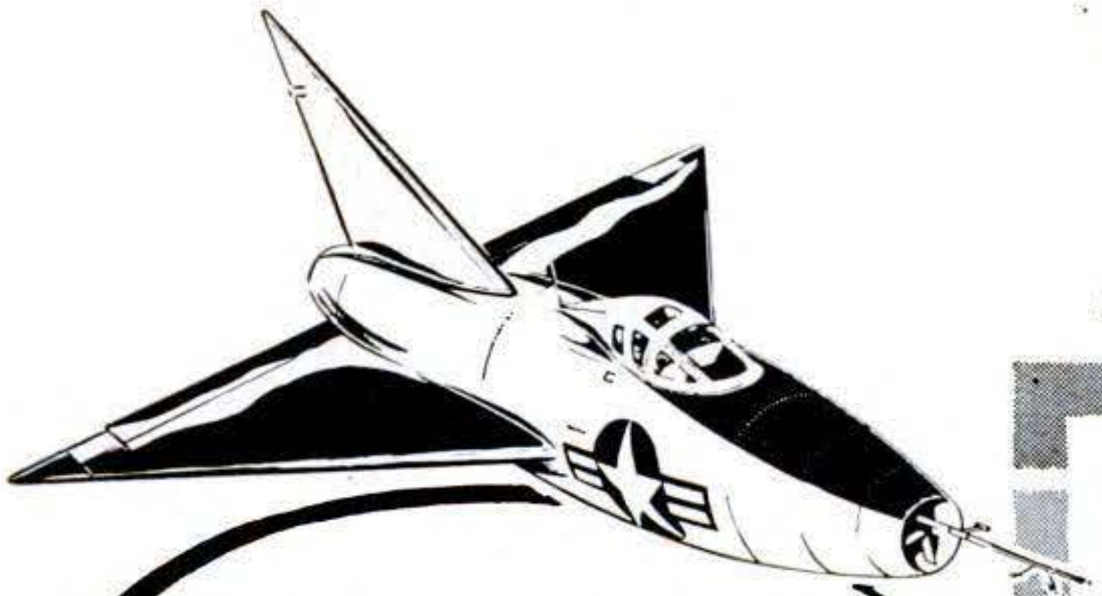

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New Plastic Primes Human Hearts
[Continued from page 208]

ing various chemicals at this pressure with copper as a catalyst, came tumbling a new world of synthetic products.

In February 1940, Weese outlined his requirements to Reppe. He needed a material that was water-soluble, was not alien to the human system, and had a finely dispersed chemical structure like that of plasma. Reppe pointed immediately to a bottle of PVP on his shelf.

"If it's not toxic," he said, "it's what we need."

Intensive animal tests by Dr. Weese produced dramatic results. Animals at the point of death from bleeding quickly recovered when a PVP solution was let into their veins, and maintained normal blood pressures from 12 to 24 hours without a sign of ill effect. Later tests on hundreds of human patients gave similar results.

Altogether, PVP was given to more than 800,000 persons during the war. So successful was the plastic plasma that today PVP continues to be a standard treatment for emergency cases not only in Germany, but in France, Italy, Belgium, and other countries.

Unknown Here Until Recently

For several years after the war, PVP remained virtually unknown to the United States. The General Aniline & Film Corp., however, had acquired American manufacturing rights to the Reppe processes, and with them thousands of samples of Reppe-chemistry products. In 1947 these were sent for routine evaluation to the Industrial Toxicology Laboratory, in Philadelphia. It was just by chance one day that Dr. Herman Shelanski, head of the laboratory, picked up a dusty bottle and deciphered enough of the labeling to see that the material was intended as a plasma substitute. His curiosity aroused, Shelanski dug into the German literature. He refused to believe what he read. With the intention of proving the Germans wrong, he launched a series of experiments on cats.

As a toxicologist, Shelanski could scarcely believe the evidence of the non-toxicity of this plastic material. He took the drastic measure of feeding straight PVP powder by mouth to various kinds of animals—sometimes in doses the equivalent of 15 pounds for a 150-pound man. All the

[Continued on page 230]

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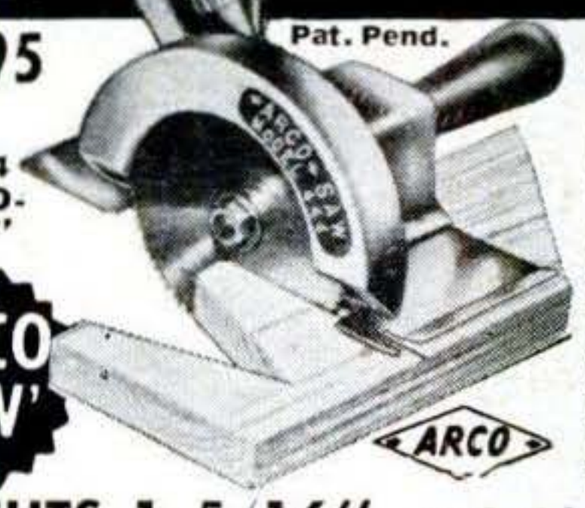

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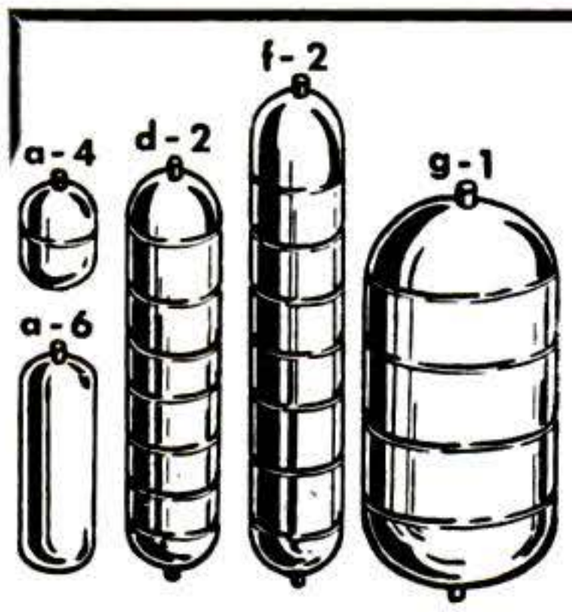

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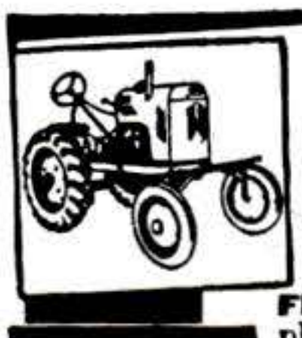

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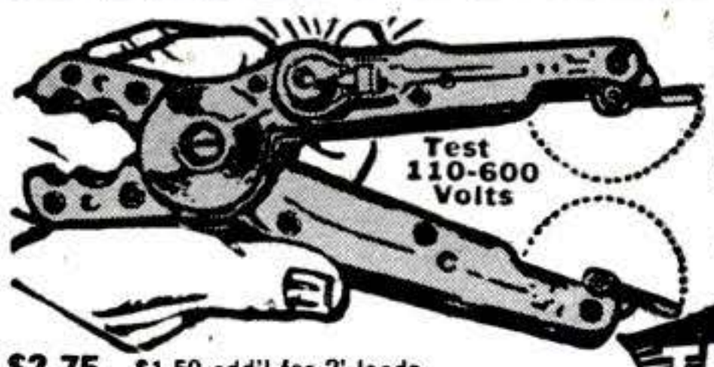

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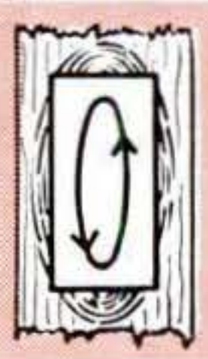

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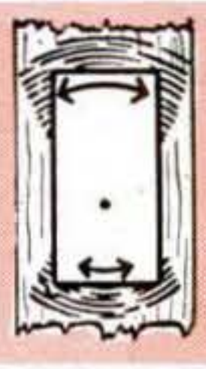

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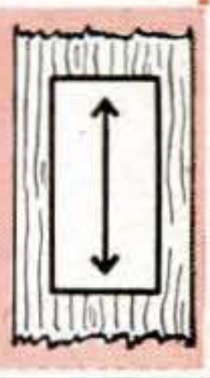

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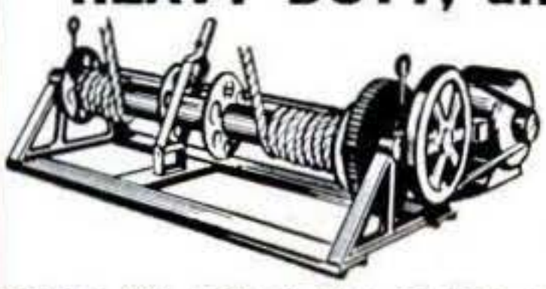

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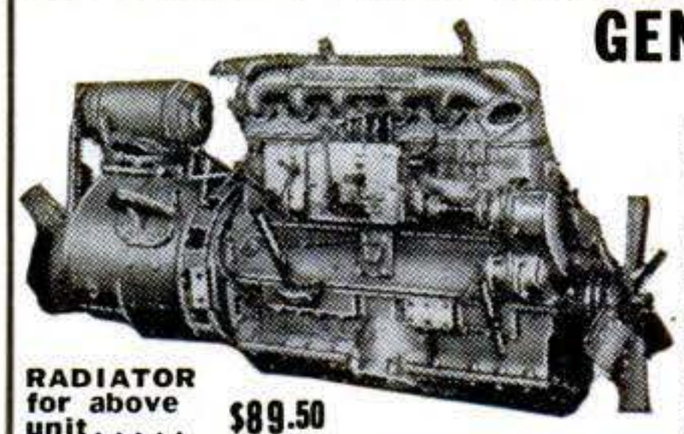

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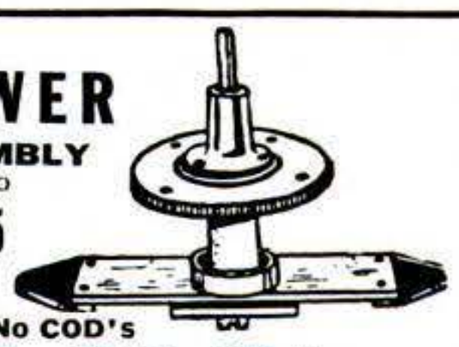

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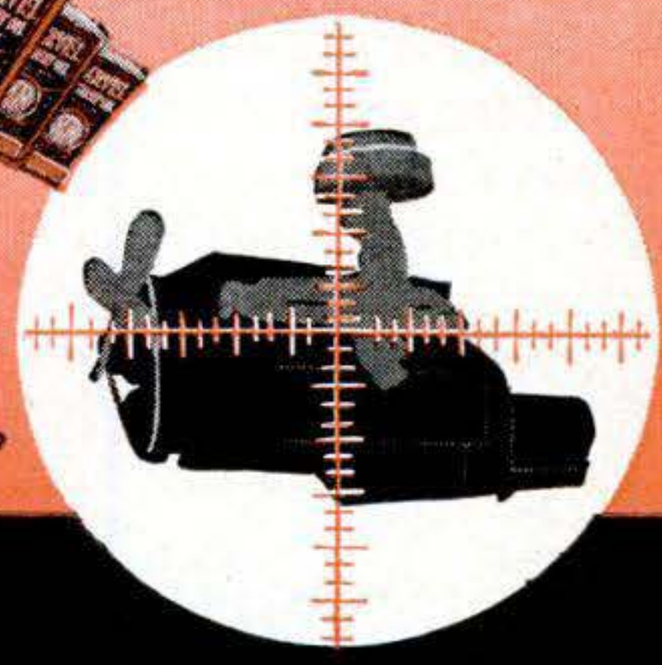

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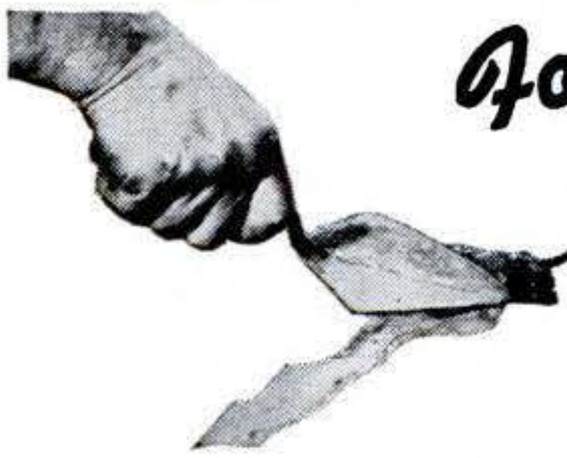

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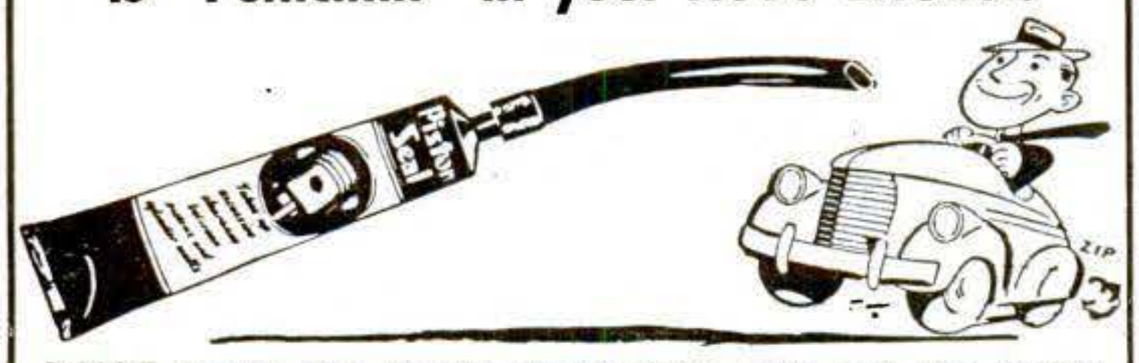

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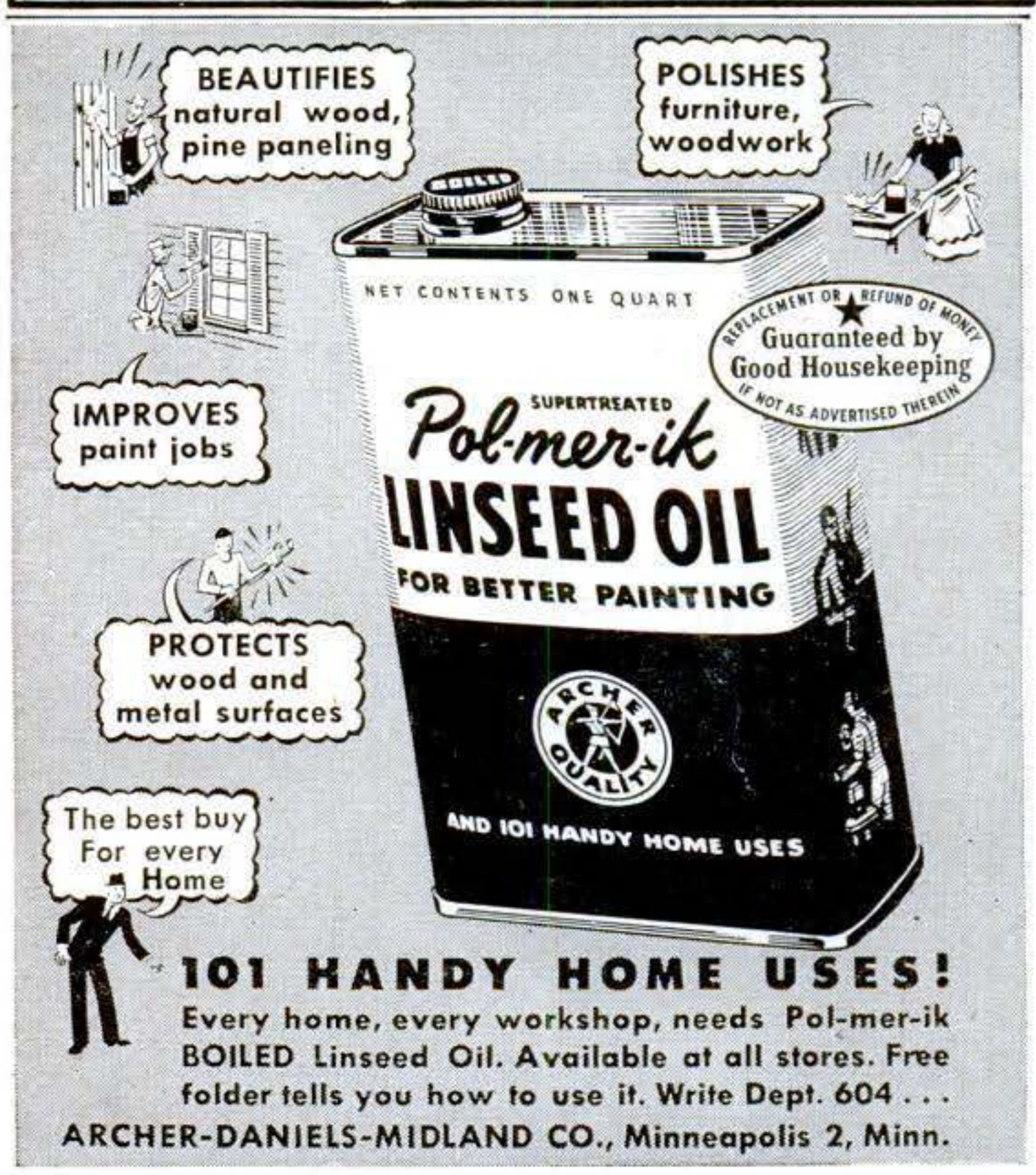

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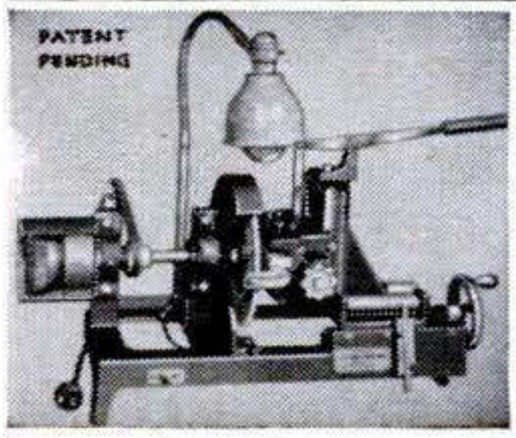

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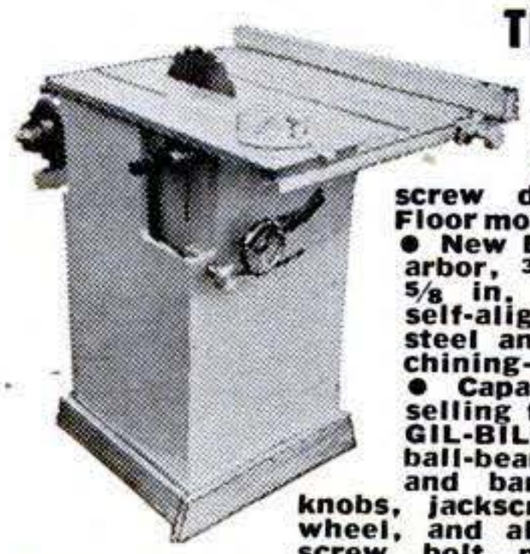

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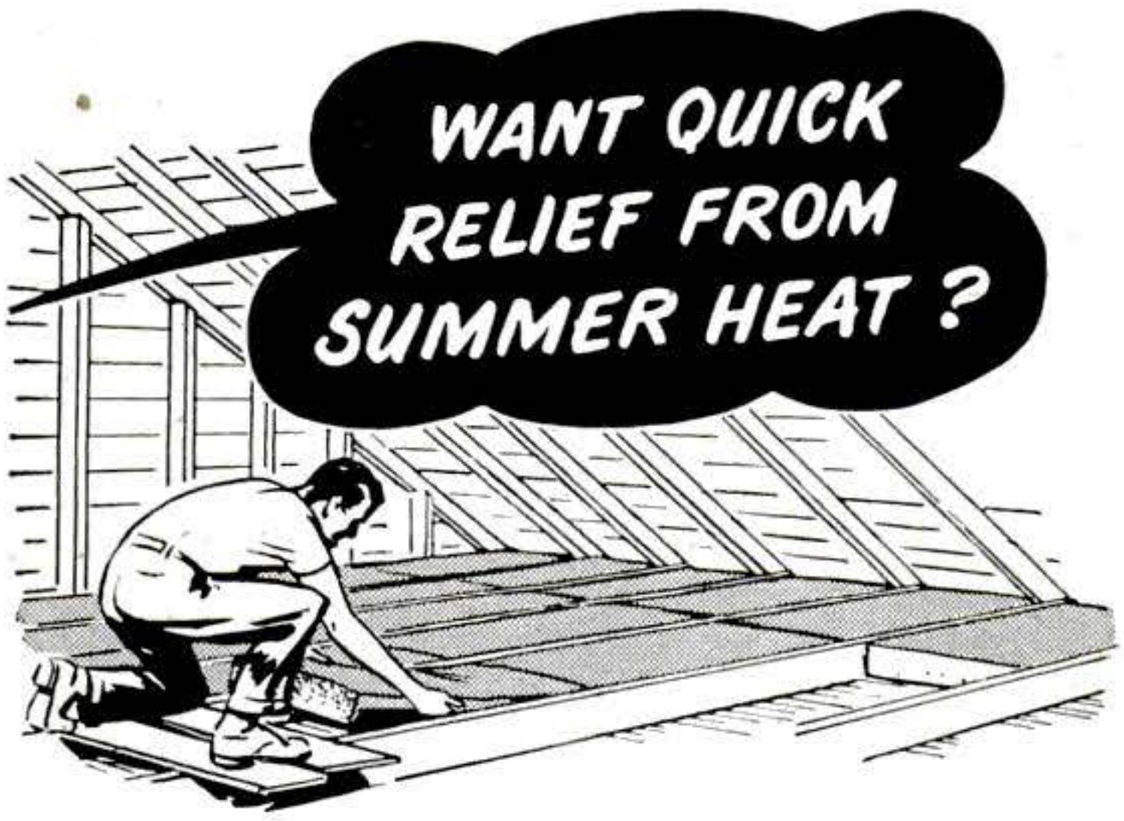

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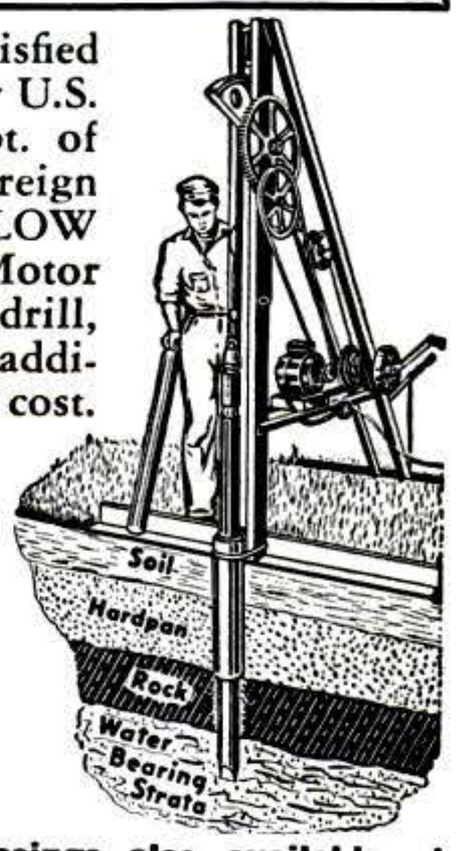

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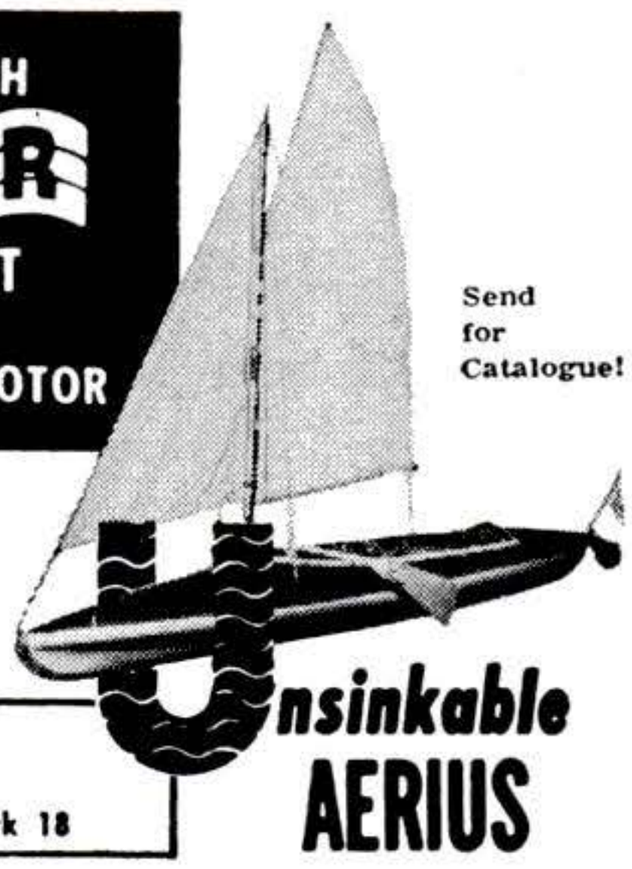

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SET 15 Different Size High Speed Morse Taper Shank Drills up to 9/16" with No. 1 and 2 tapers. $50.00 value. Priced at only.... **$6.49**

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SET 7Q 5 Different Size H.S. Drills, ½" to 1", all with ½" Shanks **$6.95**

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These H. S. precision drills can be used in a ½" electric drill or a ½" capacity lathe or drill press.

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Over 300 pcs. (2 lbs.) of used High Speed Drill Bits up to ¼". Some require sharpening. Ideal for pin punches, drift pins, etc. Less than 1c ea. at..... **$2.98**

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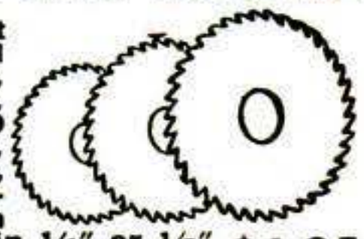

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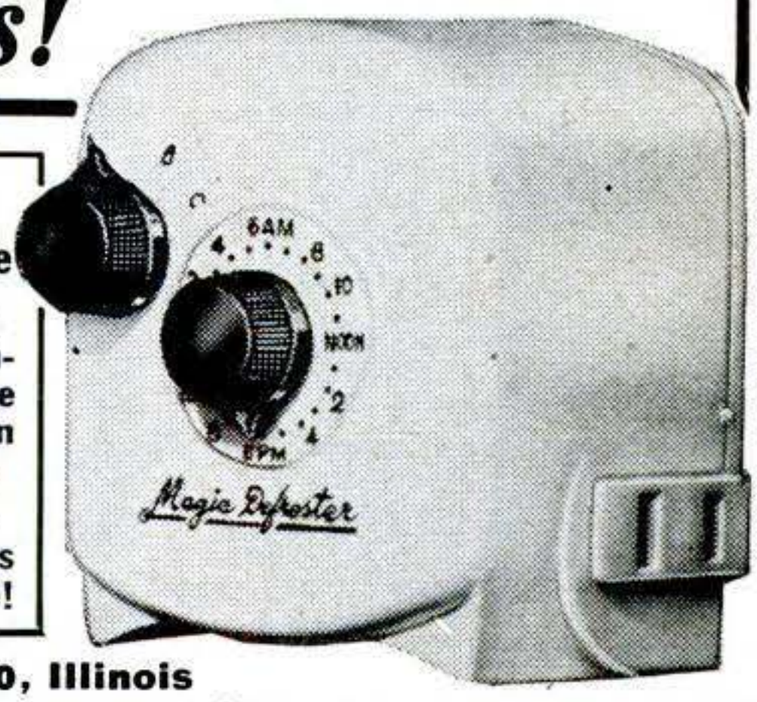

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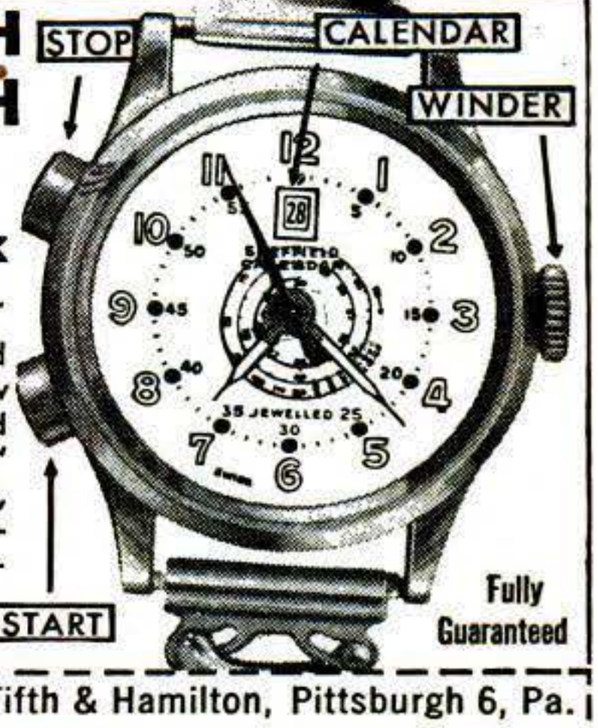

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A First Aid to Car Washing

BUGS-OFF quickly and thoroughly removes all bugs, insects and organic matter from any automobile finish.

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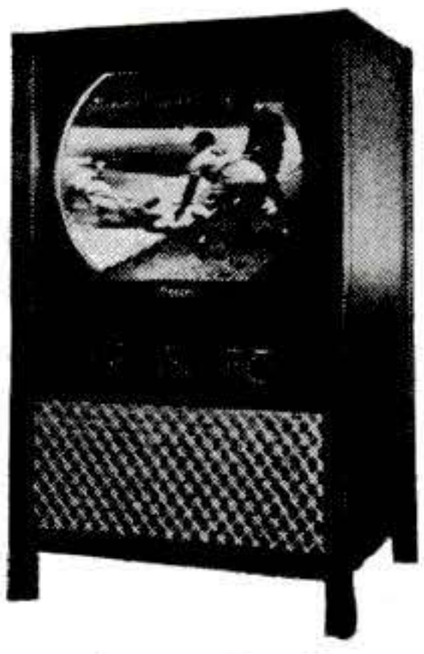

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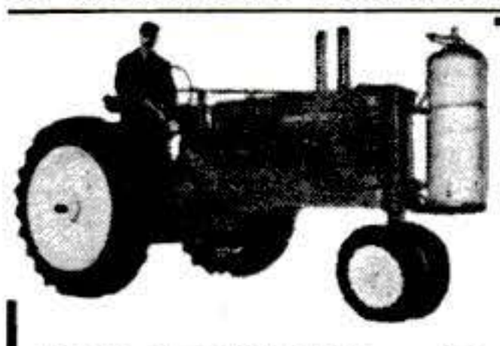

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600x15	9.98	650x16	12.48	670x15	11.98	760x15	13.98
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650x15	5.98	710x15	6.48	700x20	12.88	1000x20	19.98
700x15	6.68	550x18	5.98	32x6(8)	10.48	1000x22	21.98
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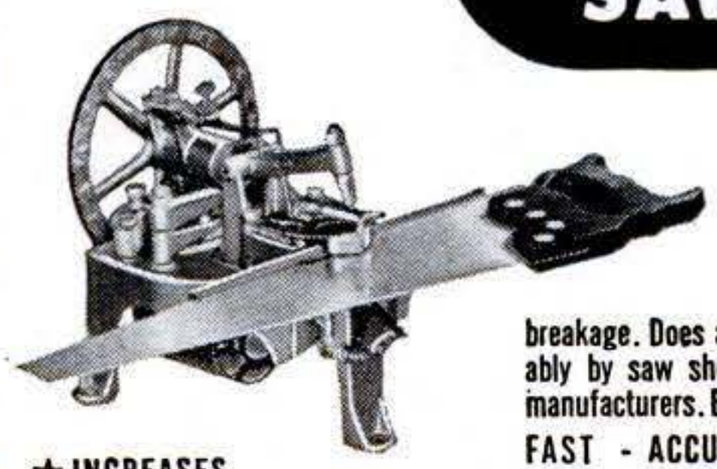

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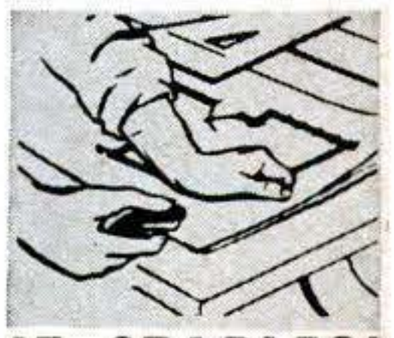

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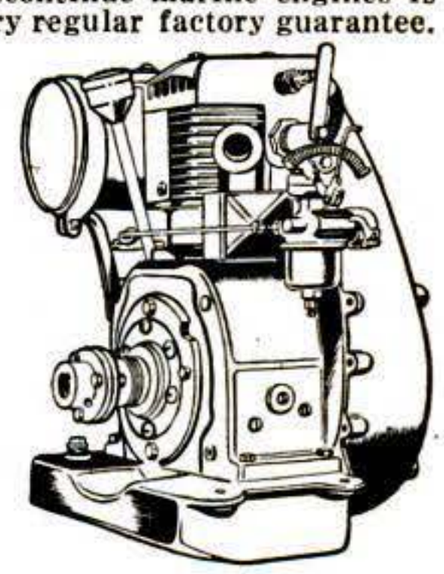

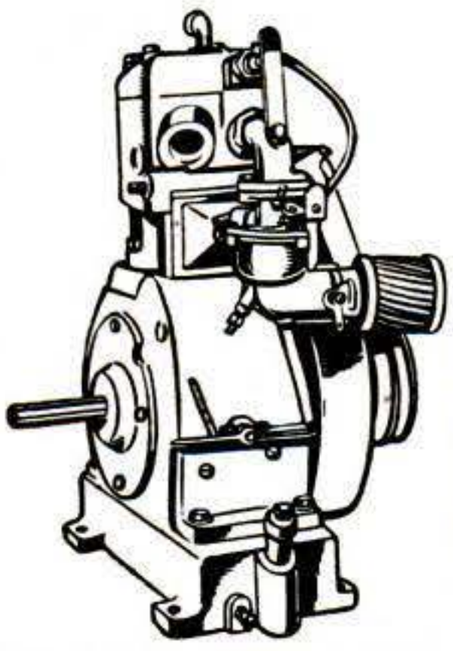

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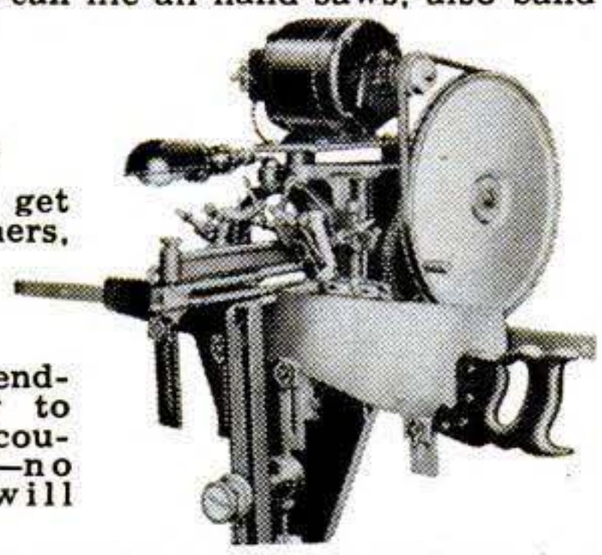

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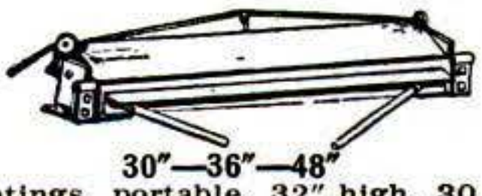

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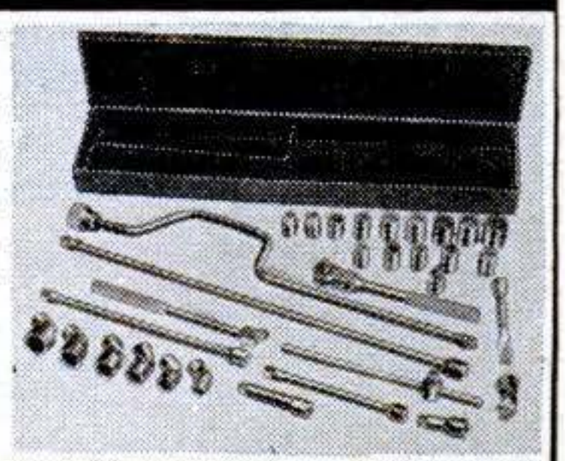

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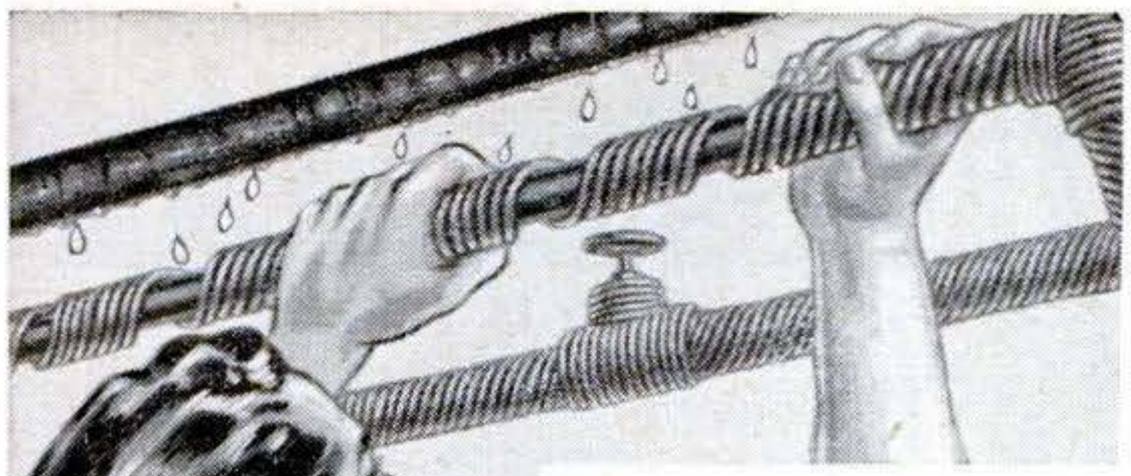

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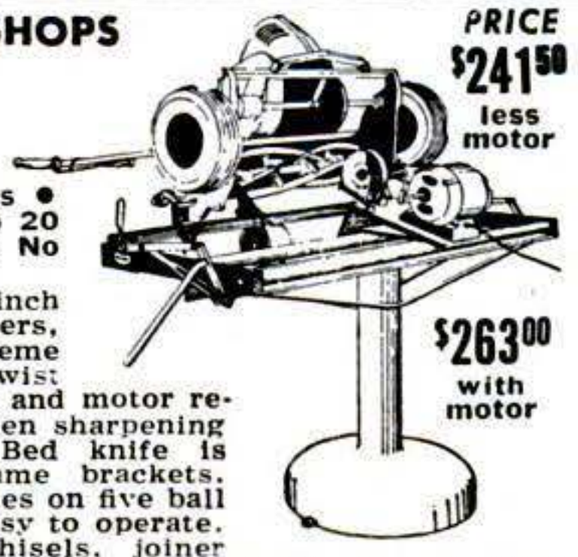

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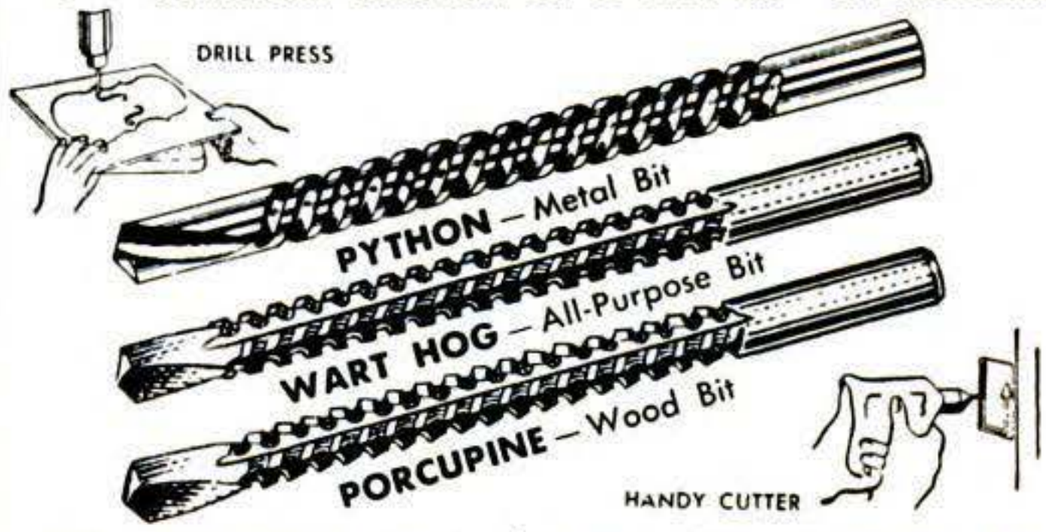

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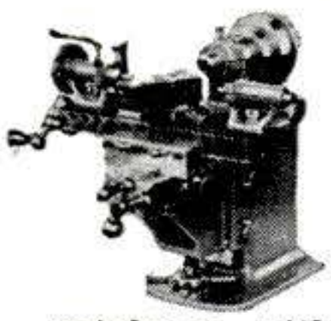

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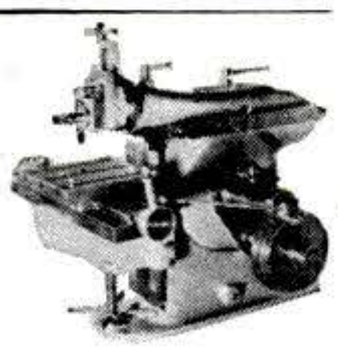

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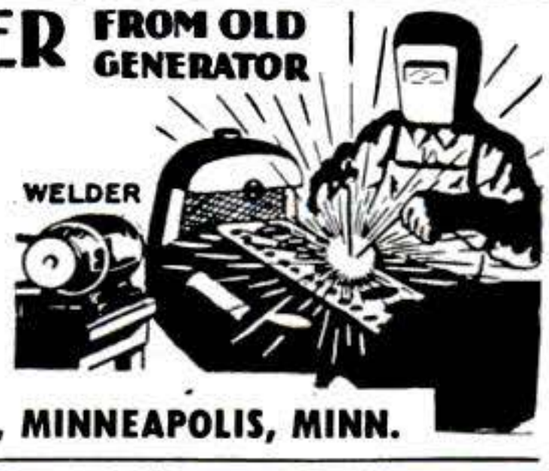

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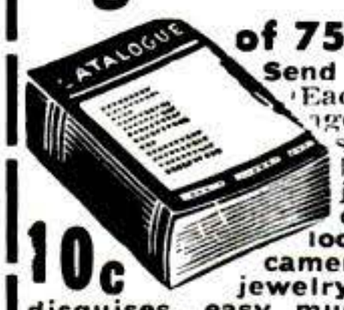

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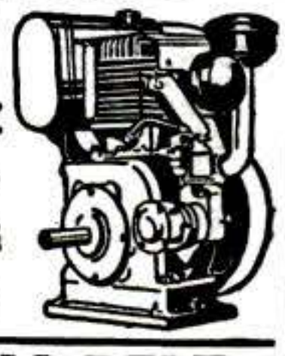

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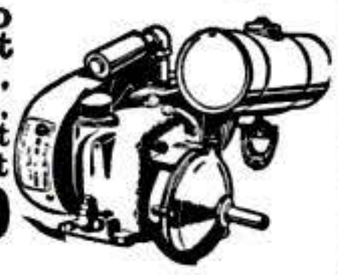

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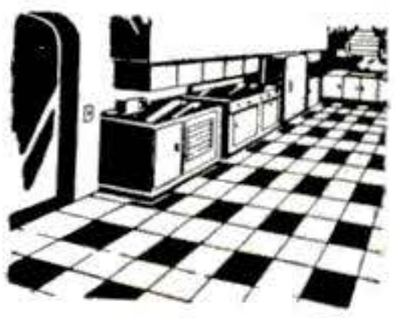

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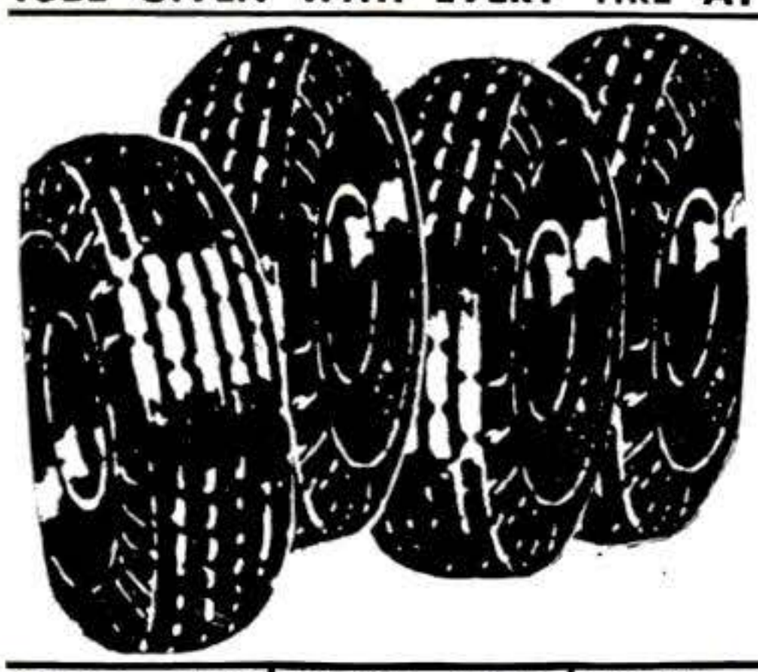

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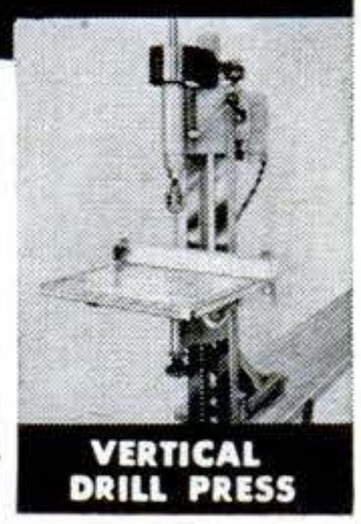

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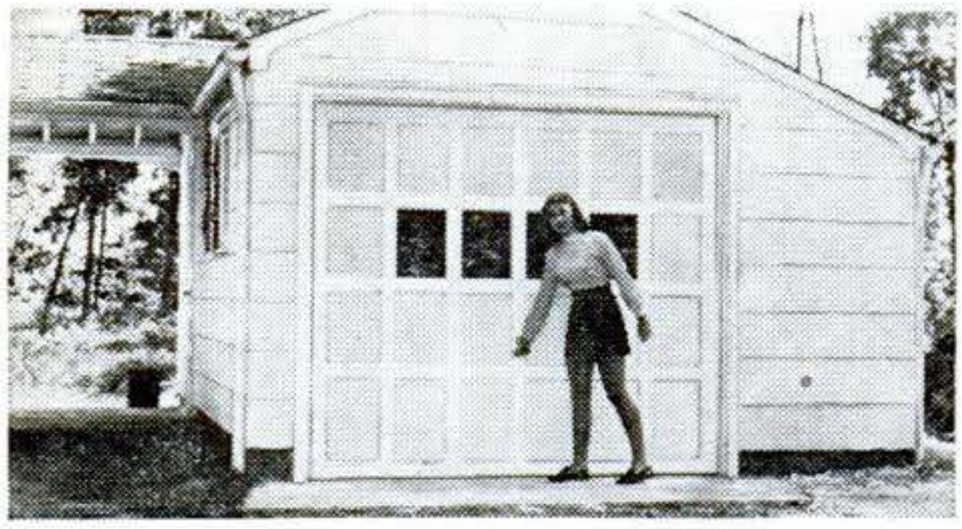

SAVE MONEY . . . BUILD YOUR OWN GARAGE DOOR. With Easi-Build* — Build It Yourself Pattern No. 86 you can build either a single or double Garage Door for less than ½ present costs. Pattern tells what materials to buy, where and when each is used. No special tools or skill required. Even though you haven't used tools in years, you'll be amazed to see how easily and economically you can build a professional looking door by following the simplified step-by-step procedure outlined in this pattern.

With "Stanley's" new Garage Door Set, you can install the Swing-Up-Hardware using only hand tools. Ask your dealer for Simplified Directions for installing Stanley Swing-Up Hardware and Easi-Build Garage Door Patterns — or send 50c for pattern No. 86 direct to:

EASI-BUILD PATTERN COMPANY
Dept. ST, Pleasantville, N. Y.

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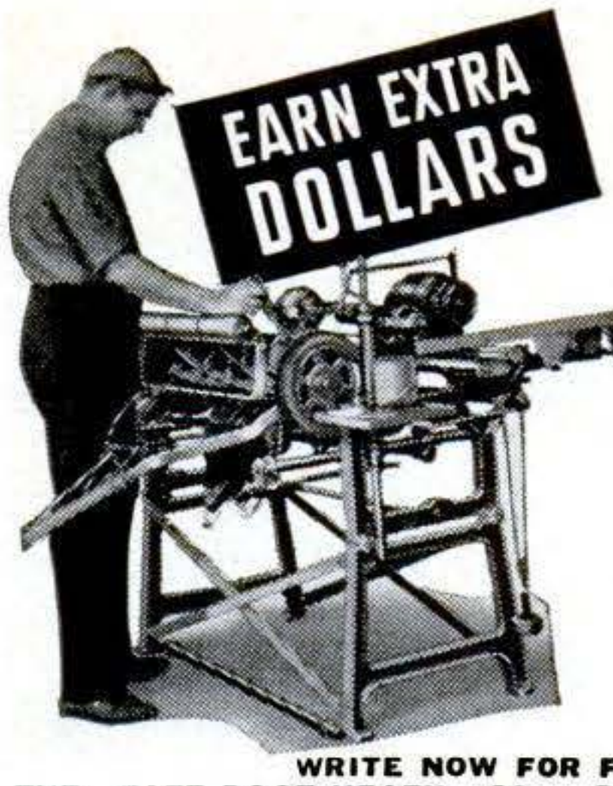

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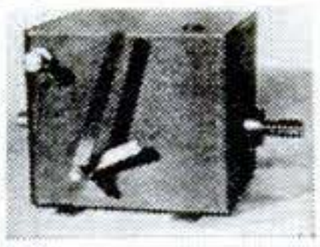

It has Infinite Speeds 0 to 550 Reverse Automatic Overload Protection; Adjustable Torque up to 180 inch pounds. 5/8" Input and Output Shafts. It will handle ¼ to 1½ H.P. Motor. Case measures 7½" long 7" high 6⅛" wide. VALUE OVER $300. Shipping Wt. 25#. On C.O.D. Orders we require a 10% Deposit.

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CORED STOCK – Smooth one side, "cored" on other side to give max. resilience & reduce weight. Ideal for chairs, cots, beds, bunks etc.

thick – per. sq. ft.		thick – per sq. ft	
1"	.80	3"	$1.70
1½"	1.10	4"	3.00
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SLAB STOCK – Smooth both sides. A solid but spongy material. Use for pads or shock-absorbing layer pads.

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1/4"	$.25
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3/8"	.38
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1"	1.00
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TOPPER PADS

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17½ x 20-1/4" x 2" . . $2.39
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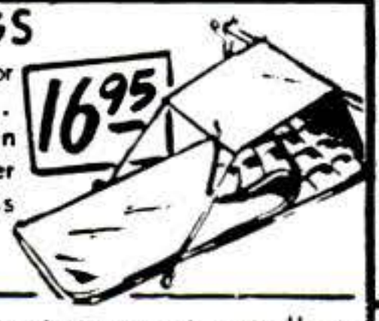

100% KAPOK FILLED BAG – a real treasure for hiker or camper. Special heavy duty, water repellent outer cover . . filled with 3 lbs. imported Kapok . . Has 100" zipper down side and across bottom. Large head flap makes dust cover to keep bag dry and clean when rolled up. Large air mattress pocket. Zip to another bag for double-up sleeping. Wt. 7 lbs. Size 34" x 78" 16.95

MUMMY TYPE BAG Has an outer cover of forest green, water repellent, balloon cloth. Filled with 15% Duck Down and 85% Chicken Feathers. Closes with 3/4 length zipper. Size is 34" by 77". 15.95

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Ideal for fishing or fun! Safe, Lightweight, Re-conditioned & ready! Easy to pack and carry. Complete with carrying case.

1 MAN with PADDLES 14.95 — 4 & 5 MAN 29.95 — 7 MAN 42.50 — Oars 2.95 PR. — Pump 2.95 EA.

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A MUST for the Fisherman and Boat Owner. Why Take Chances? BE SAFE! Have one for each person aboard. Easily inflated by mouth or sparklette bottle charge. 2.49

SWIM FLIPPERS

Top quality rubber. Has pebble tread bottom. Adj. heel strap . . . Re-inforced for strength. Vented for air & drainage. Ideal for diving and swimming.

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DIVING MASK

Soft rubber mask fits over eyes. Heavy duty glass shield. Adj. headband.

Jr. 4½" 2.59 — Miss 5" 2.69 — Mr. 5½" 3.95

FISHING SPEAR

Corrosion resistant. Ideal for spear fishing. 11" long with barbed end. Dia. of socket 1" 49¢ EA. 3 for $1.19

WADING SUIT

Makes surf and stream fishing a pleasure! Made of rubberized canvas with vulcanized seams. Has inner air pockets to give buoyancy and balance in deep water. The rubber gloves & half length boots are vulcanized to sleeves and pants legs. Sizes: – Small, Med., Lge. 6.95

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STRONG – LIGHTWEIGHT – NYLON FISHING LINE. ROT-PROOF and WATERPROOF . . Especially treated for strength and long life. ON SPOOLS.

1500 ft.	10 lb.		$1.59
1000 ft.	25 lb.		$1.80
750 ft.	45 lb.		$3.29
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A precision officers' type compass of unusual accuracy. Has prismatic hair line guide for sighting a distant object and at same time reading number of degrees. Luminous dial for night. Jewel mounted needle. Canvas carrying case for belt 2.95

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U. S. Navy, Portable type. Has Pistol Grip and aiming sight. Makes an ideal search, spot or emergency light for your auto, boat, farm, etc.

12V. light – 4" lens . 3.29
24V light – 5" lens . 3.79
Set of 3 filters – red, green, amber . (specify type lamp) 99¢

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Finest precision Acromatic optics 5 double element lenses corrected for color & spherical aberration. Has dot reticle. 3 POWER magnification with 16mm dia., objective & 22mm eye lenses. 8.95

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20 Inch TANK TELESCOPES
3 Power . . $4.95 – – 20 Power . . $8.95

GENUINE GOGGLES

Aviators (AN-6530) Windproof & Dustproof

Rubber or chamois covered frame. Clear or Green GROUND LENSES are inter-changeable. Adjustable nose bar. Ideal for flying, motor cycling, etc 2.19

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1-9qt. Plastic container for ice, etc. Each section individual – Case of Sturdy Plastic with carrying handle. 9.95

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[Continued from page 210]

animals were unaffected; the PVP passed apparently unchanged through their digestive tracts.

The next step was to try it on humans. Dr. Shelanski enlisted the aid of Drs. Jefferson Clark and Dryden Morse, of the staff of Philadelphia General Hospital. Patients with short life expectancy were selected for the first tests because autopsy studies would be available. Thirty-three patients were infused with the PVP solution in various quantities. The conclusions, as published by Dr. Clark: PVP is able to maintain or increase the blood pressure for at least 18 hours; it is inert, nontoxic, and is not stored permanently in any of the tissues.

Meanwhile, the Mayo Clinic, in Rochester, Minn., working independently, had tested PVP obtained from Germany on a number of surgical shock cases, and in July, 1949, published a favorable report.

About this time the General Aniline management made a weighty decision. On the basis of Dr. Shelanski's reports, they decided to turn all the facilities of their new acetylene plant at Grasselli, N. J., to the production of PVP. Presently, under the direction of the Winternitz NRC committee, thousands of bottles of PVP solution were being supplied free of charge to hospitals for further testing research.

Safe Stockpile Within a Year

Today the General Aniline plant is turning out enough PVP powder for 300,000 pints of solution per month, and by next January will supply 1,200,000 pints per month. Another 300,000 pints per month may be bottled by Schenley Laboratories, which is obtaining the PVP powder from Germany. Together with the supply of Dextran, which will soon be available at a rate of about 65,000 pints per month, it appears that a safe stockpile of plasma substitutes may be achieved within a year.

PVP is *not* a substitute for whole blood. There can never be a substitute for that. And far from reducing the need for blood donations, the use of PVP stands to increase it. For, as one doctor has pointed out, widespread availability of such an inexpensive, easily administered "shock solution" should save many patients who would not otherwise live to require blood.

PVP solution is now being used throughout the Philadelphia General Hospital at a cost of about one-seventh that of plasma. Altogether, it is in use at 40 to 50 hospitals, and in several hundred cases not one unfavorable result has been experienced.

If this amazing plastic were useful only as a plasma-substitute it would still represent an outstanding medical development. Actually, PVP appears to have additional properties which have prompted one British investigator to rank it in importance with the sulfa drugs. Investigation of these is still in the experimental stage in the United States. But the indications are spectacular.

Evidence from abroad, for example, indicates that PVP has an outstanding ability to prolong the effectiveness of drugs in the body. Many of the most valuable drugs, such as penicillin, adrenalin, and insulin, are costly to use because they are quickly absorbed by the tissues and eliminated from the body, requiring frequently repeated injections. When such drugs are mixed with a PVP solution, however, their life is extended from two to four times.

It Detoxifies Poisons

Even more startling was the discovery in Germany that PVP was not merely nontoxic—it was phenomenally *detoxifying*. The microscopic particles of PVP apparently have a strong attraction for poisons, picking them up in the bloodstream and carrying them directly to the kidneys, where they are expelled.

According to Dr. James Manning Walker, of the University of Pennsylvania, the toxin-removal effect of PVP has been applied by the Germans to cases of severe diphtheria in children, cutting the mortality rate to less than half what it was when diphtheria antitoxin alone was used.

Pondering this, Dr. Shelanski fell to thinking of the most powerful of all antiseptics: iodine. Iodine is toxic. But if PVP would neutralize the toxicity, perhaps iodine could be used, even internally, to kill invading germs before they could get established in the body.

Thus have the urgencies of atomic defense brought about a long forward step in medicine, of potentially great life-saving possibilities in war or peace—and opened up new fields of research which promise truly revolutionary developments. END

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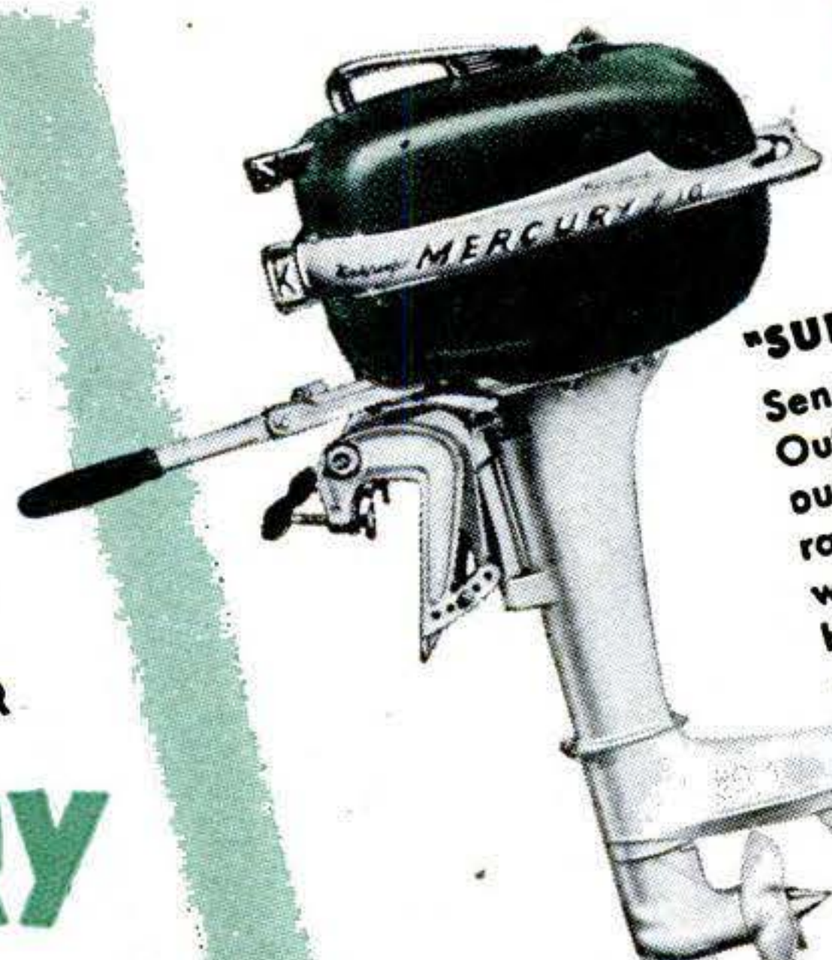
outboard motor



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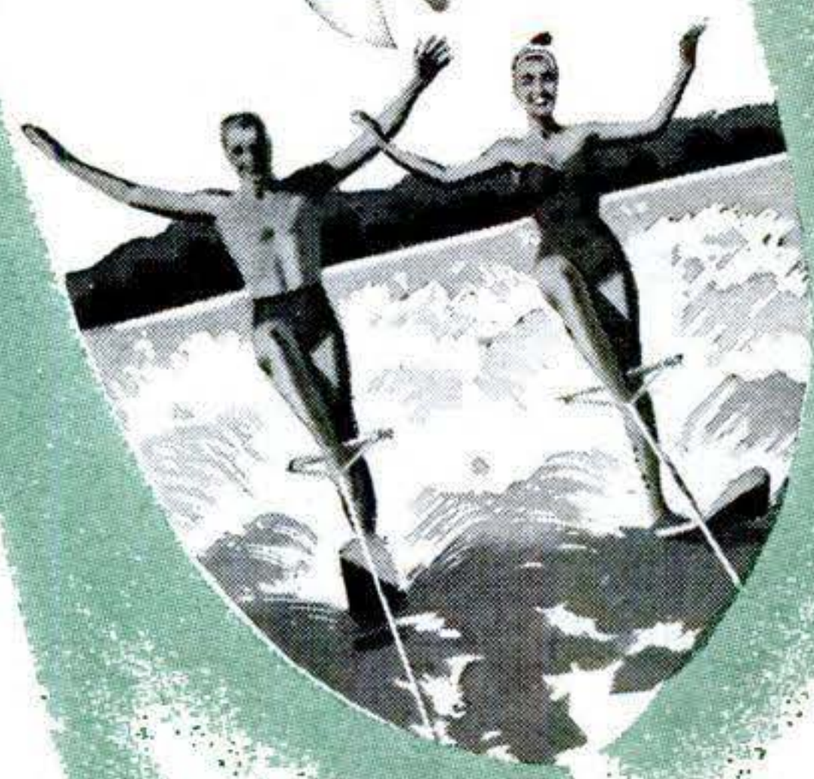

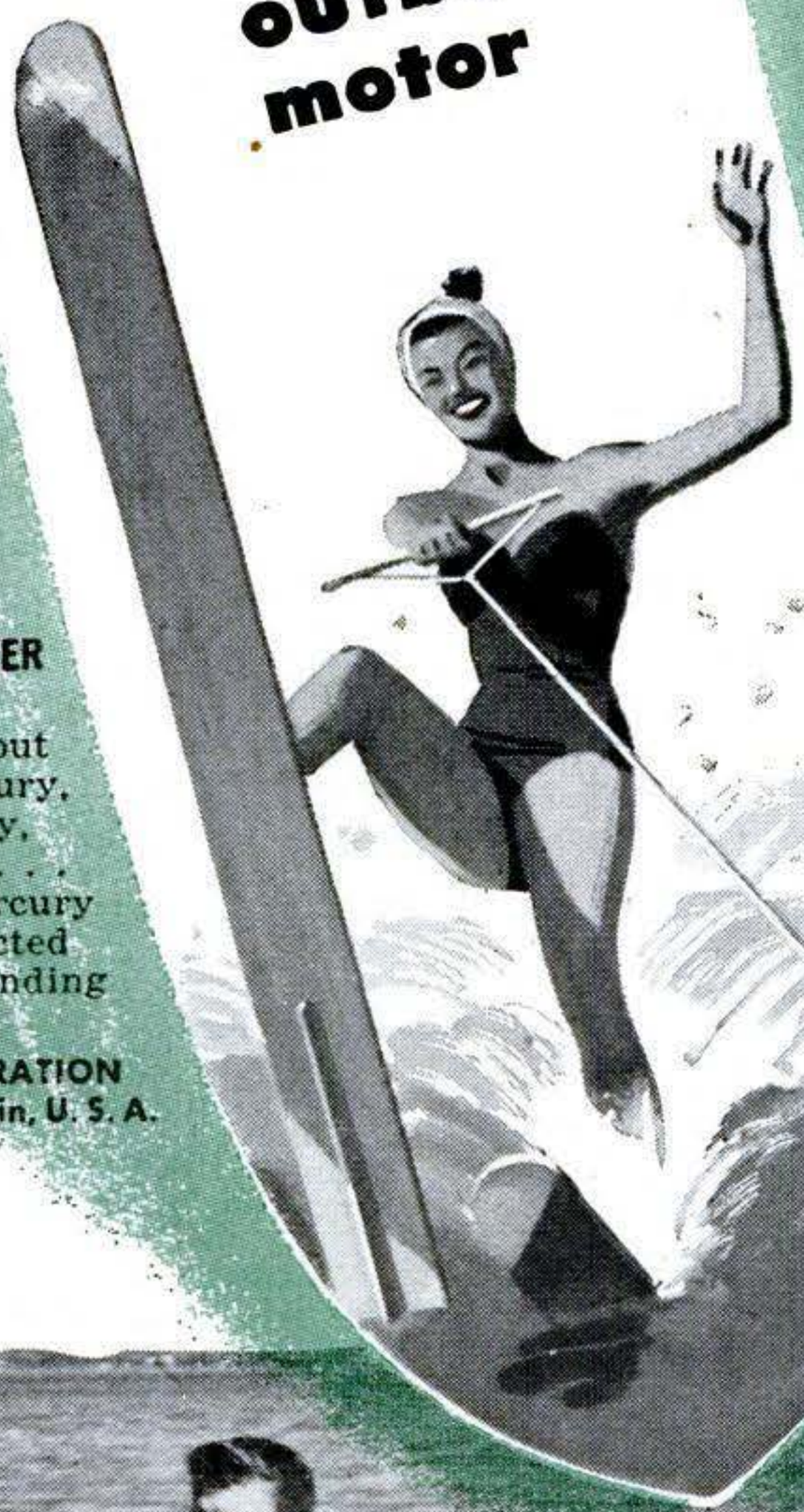

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Learn to fix, convert and make custom-made guns with

GUNSMITHING SIMPLIFIED

IDEAL HAND B

by HAROLD E. MACFARLAND

Harold MacFarland tears the "Top Secret" classification off a lot of gunsmithing mysteries. He reveals many professional secrets that save hours of work, produce better guns, and leave you with money to spare. He has devised many short cuts and new methods himself, and in the true rifleman spirit he tells you how to use them.

ACCEPTED by the NATIONAL RIFLE ASSOC. as the standard book on this subject

One of the hottest scoops in gunsmithing history is his safety breeching — a method of converting military rifles so the cartridge head is fully enclosed. His quick and easy system for barrel removal will make you kick yourself for not thinking of it on your own. The inertia bullet puller he tells you about is one of the slickest, quickest tricks you've ever seen. And these are only three of the many, many practical tips in the book.

Starting with the work bench, MacFarland clearly tells you how to gunsmith from A to Z. Where to get your tools, how to get discounts, modernizing sporting rifles, converting military rifles, handguns, shotguns, chambering, carving, stockmaking, trigger adjustment, how to make tools and small parts. All this and much, much more besides are in his practical book. No punches are pulled. He gives an honestly critical opinion whenever he thinks it will help the professional or the kitchen gunsmith. MacFarland's not selling anything but facts.

The kitchen or cellar gunsmith, the part-time semi-pro and the professional will all find practical, useful, time- and money-saving information in Gunsmithing Simplified.

Start now to save money with these fun-filled hobbies. Mail the card today for your bargain rate on these two outstanding books.

You can reload your own ammunition s while you save money. This new editio 184 pages with the latest data for safe It contains over 350 helpful illustratio

Contains seven big sections: How to Information; Cartridge Characteristic Muzzle Loading; Shot Shell Reloadin formation. This attractive edition is pl for easy reference.

With a work bench and a few inexpensi load. Like gunsmithing, you learn quickly how to do simple operations. But there's no limit on how much you can progress and learn about both reloading and gunsmithing. They are interesting, fascinating hobbies that may become means of earning a living as well as saving yourself money.

You can produce ammunition to fill *your exacting needs.* You'll save plenty! Why, you can make a year's supply of some ammunition for your usual purchase price of *one* carton of it.

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Special Combination Offer

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Regular Retail Price $7.95

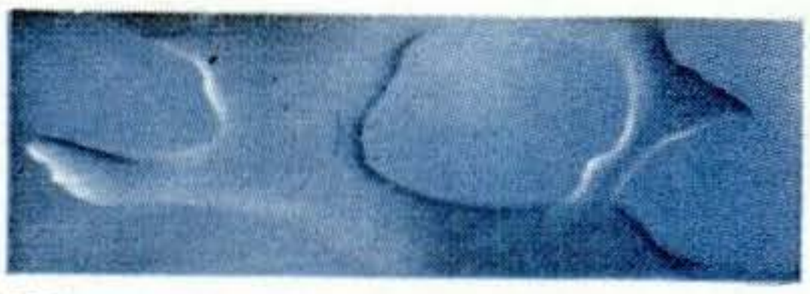
In 20 minutes - without rubbing - CAR-PLATE waxes your car with longer-lasting protection!

Raindrops prove it

in test after test!

"Water beads" demonstrate protection!

When rain "beads up" on a clean car (see above), you know there is a solid film of wax on the finish to give tough protection against the weather. On a Car-Plate finish the wax protection lasts for a longer period of time than with any ordinary wax or polish.



When rain flattens into pools (see above) on a clean car, you know there is little or no wax protection left on the car's finish. When ordinary waxes or polishes are used, the wax protection doesn't last as long as when you use Car-Plate!

The easy Car-Plate way to wax your car is the best way!

These pictures prove it! In test after test, the Car-Plate finish was still smooth and gleaming with wax protection after weeks of driving . . . while other waxes and liquid polishes had worn away!

Today . . . get Johnson's Car-Plate at your service station or wax dealer's. Spread it on the cleaned finish* ...let it dry...then wipe it off. That's all you do to give your car the smoothest, brightest, longest-wearing waxing it has ever had!

Even a hard-rub professional wax job costing $15 and more doesn't give your car more protection than Johnson's 20-minute Car-Plate!

*The easy way to prepare the finish of your car for a Car-Plate waxing is to clean it super-clean with Johnson's Carnu. For exceptionally dirty cars, ask your dealer for Johnson's Heavy-Duty Cleaner.

Johnson's CAR-PLATE

—the 20-minute auto wax described in Reader's Digest!

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